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VOLUME XV OCTOBER 4, 1926 NUMBER 17

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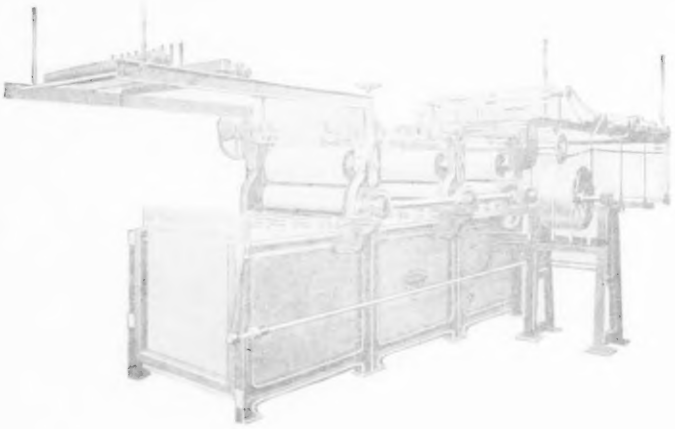

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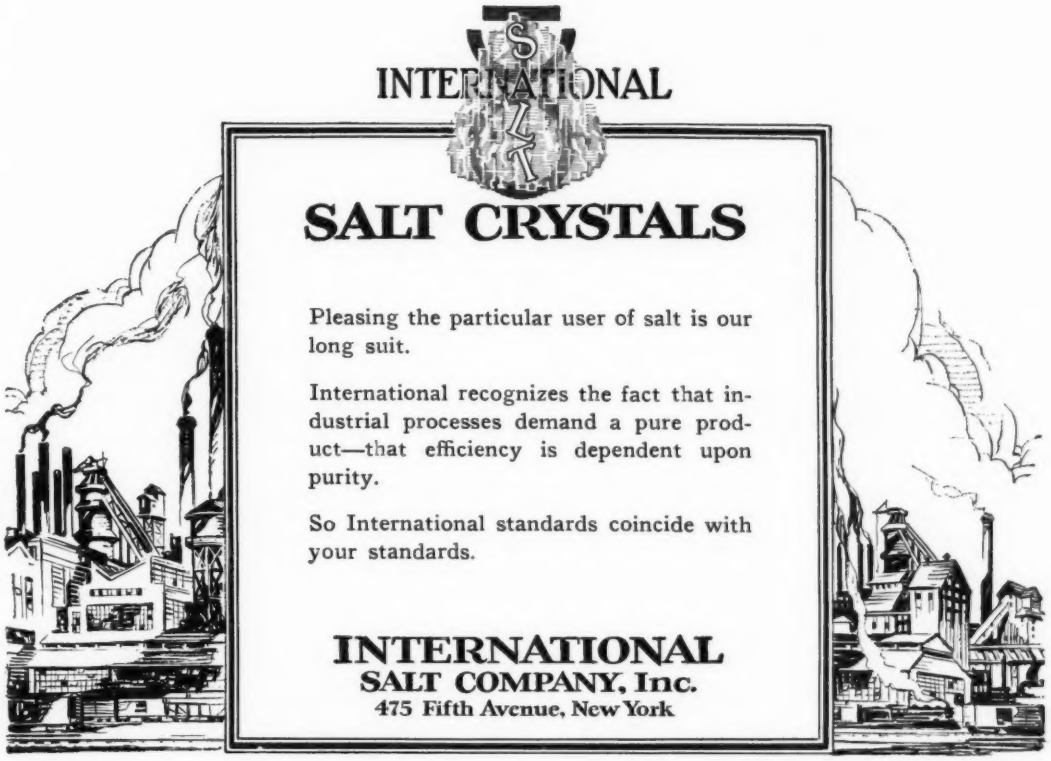
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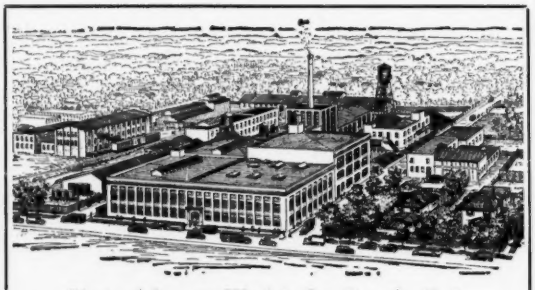

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VOLUME XV NEW YORK, OCTOBER 4, 1926 No. 17

The Chemical Reactions of Keratin and Its Congeners

The Actions of Various Chemicals, Reagents, Etc., on the Keratins as a Class

Part I

Structure and Variations of the Keratins—Action of Heat, Light and Water—The Action of Acids and Alkalies

By CHAS. E. MULLIN, M.Sc., F.A.I.C.

Consulting Chemist, Camden, N. J.

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NOW that we have seen how, why, and under what conditions the various acids, bases etc., unite with the proteins, including wool, to form definite chemical compounds, we will review some of the literature upon the action of various reagents upon the keratins and related products in general, before taking up their action on our pet protein, wool. While all of the members of the keratin group do not react in the same way with the different reagents, as a class they have certain properties in common.*

As pointed out in a previous paper, the keratins are found in wool, fur, hair, feathers, nails, scales, horns, hoofs, the epidermal layer of the skin, skins of eggshells, etc. While many past investigators have considered keratin as a single definite substance and assigned it a chemical formula (see Mills and Takamine, *J. Chem. Soc. 43*, 142 (1883)), the most recent investigators are inclined to consider the keratins as a group of compounds of more or less closely related composition and properties. Undoubtedly all of our naturally occurring keratins, such as wool, are mixtures of several, or perhaps a much larger number, of related protein compounds. Probably the amount of the various constituent keratins of wool-keratin varies more or less in the wool from different breeds of sheep or even in the various grades of wool from the same animal, and to an even greater extent in hair and feathers, etc.

The whole subject of the composition and constitution of wool, and in fact all other proteins, is so little understood at the present time that it is impossible to arrive at any definite conclusion on many of these points. While for the purpose of equations, the amino acids of all proteins are usually shown in peptide linkage, with only occasionally the keto, enol, or piperazine linkage, it has not yet been definitely settled that these are the only linkages or forms of combination involved, or finally settled that they are involved at all.

As a class, the resistance of the keratins to the action of chemical and other reagents, as compared with the other proteins, is remarkable. It has been suggested that this resistance is due to a special form of linkage in the keratin molecule. However, the peptide form of linkage gives most excellent service in the various hypotheses regarding the constitution and reactions of all the proteins, wool included. A brief study of the reactions of the keratins in general will probably serve to show that there are quite wide differences between the various members of this group from different sources.

In preparing the following paper, the author has found a great deal of valuable general information in Lloyd's new book, "Chemistry of the Protein" (Blakiston, Phila.), 1926. J. Barritt, "The Literature of Keratin," *J. Textile Inst. 17*, T111-26 (1926); and Bogue, "Chemistry and Technology of Gelatin and Glue," give a great

*Also see "The Proteins in General and Wool in Particular," American Dyestuff Reporter, 15, 413-7 (1926).

deal of more definite information regarding the keratins. The following references refer to these sources.

Action of Light and Heat

The action of light on the keratins is of interest in connection with the difference in the dyeing properties of the tip and root ends of the wool fiber, as well as changes in wool upon exposure to the atmosphere, etc. While probably not directly applicable to wool, as a whole, a brief review of the action of light, both visible and ultraviolet, upon other proteins may be of interest and have some bearing upon this point. This action of light as well as many other agents, on certain proteins is called denaturation. Probably there is no direct evidence that the denaturation of certain proteins has any connection with the action of light and heat on wool, yet they may be more or less related.

Denaturation, in the case of soluble proteins, is usually associated with coagulation, but they are two entirely different processes. Coagulation is a physical process, and by suitable means the coagula can be redispersed or dissolved, but under certain conditions, albumins and globulins can be coagulated or precipitated from solution by a process which is irreversible. However, the above solution of a coagulated protein differs very definitely from that of the original protein. Coagulation is not in itself an irreversible process, but in all cases it is preceded by an irreversible chemical change in the protein, which is called denaturation.

Denaturation of a protein causes a considerable change in certain of its properties, such as a complete loss of solubility in water and in dilute salt solutions, etc. However, the denatured proteins are still soluble in dilute acids or alkalies, but these solutions have quite different properties from the solution of the original protein. The change during denaturation is probably a structural rearrangement of the linkage within the protein molecule

Dreyer and Hanssen, *Compt. Rend. Acad. Sc. 145,* 234 (1907), and Young, *Proc. Royal Soc. B 93,* 235 (1922), state that both ultraviolet and visible light cause a denaturation of some proteins in much the same way as heat. Bovie, *Science 37,* 24 and 373 (1913), also studied the denaturation of proteins by ultraviolet light.

Chick and Martin have suggested that protein denaturation consists of an opening up of internal anhydride rings with combination with the elements of water at the point of cleavage. Young suggests that denaturation consists of the closing of rings within the protein molecule, with the formation of internal anhydrides.

Wu and Wu, *J. Biol. Chem. 64,* 369-78 (1925), believe that heat denaturation of protein is similar to acid and alkali denaturation, a hydrolysis, resulting in an actual cleavage of the protein molecule.

Heat causes denaturation of proteins and we are all more or less acquainted with the changes in color, feel, and other properties of wool when it is heated beyond a certain definite point, especially in the presence of alkalies. Denatured proteins do not swell in water and are completely insoluble at their isoelectric points. It is well known that the regain of overheated wool is less than that of normal wool. Is it not very probable that there is a relation between the action of light, heat and some other agents on wool, and protein denaturation?

Freund and Lustig, *Biochem. Z. 167,* 355-73 (1926), state that when a protein is coagulated by heat there is an absorption of water, diminished acid properties which are shown by a change of the hydrogen ion concentration towards the alkaline side, an increase in the free amino groups, as shown by the formal titration, and a hydrolysis giving rise mainly to fatty acids which are soluble in ether.

Lloyd, *loc. cit.,* page 242, says that at the present time it is not easy to form a satisfactory theory of the cause of denaturation, and that it is not yet certain that the different types of denaturation, that is, by heat, light, mechanical means, action of strong acids or alkalies, alcohol, etc., are brought about by the same changes in the protein molecule. Denaturation by light and heat, however, seem to be of a similar nature.

When heated in the dry state the keratoids (keratin) swell, char, and evolve a characteristic odor of burnt feathers. Heiduschka and Komm, *Z. physiol. Chem. 121,* 221-30 (1922); *124,* 37-69 (1922); *126,* 130-42, and 261-76 (1923), from a rather wide investigation of keratin, found its fusion temperature when heated in bomb tubes alone, and together with water and concentrated ammonia, to be 225-30 deg., 200 deg. and 208 deg. Cent., respectively. When heated *in vacuo* or at atmospheric pressure nothing happens below 250 deg. Cent., fusion then occurs and distillation begins. They also studied the precipitation of its decomposition products with ammonium sulphate and zinc sulphate in neutral and acid solutions.

Water

Most of the keratoids are hydroscopic, taking up considerable moisture from moist air or water from aqueous solutions, without affording any indication of its presence except by the increase in weight and a change in its mechanical properties. Very little has been done upon the equilibrium moisture (regain or condition) content of the keratins outside of wool, silk and gelatin. Barritt does not give an opinion as to whether this water is held chemically, mechanically, or by a combination of the two processes. (Also see the properties of wool in a future paper of this series.)

The keratoids are quite insoluble in alcohol and ether, and are not seriously affected by boiling water at the ordinary pressure. However, it has been shown by Gardner and Carter, *J. Soc. Dyers and Colourists 14,* 167-9 (1898), and Herz and Barraclough, *J. Soc. Dyers and Colourists 25,* 274-6 (1909); *26,* 28 (1910), as well as

others, in the case of wool, that some soluble matter or "wool gelatin" is removed from the fiber by hot water alone. Herz and Barraclough believes this "gelatin" is a mixture of three substances and states that it is acid towards litmus. Undoubtedly the quantity and character of the material removed from wool by water will vary considerably, according to the conditions. This phase of the matter will be considered fully under the action of water on wool. H. and B. give Table XVI, showing the reactions of a one per cent solution of wool gelatin, as compared with a true gelatin solution of the same concentration:

TABLE XVI

The Reactions of "Wool Gelatin" Compared with Gelatin

	Wool Gelatin	Gelatin
Chlorine	Ppt.	Ppt.
Plantinic chloride	Cloudy	Ppt.
Tannin	Ppt.	Ppt.
Alcohol	Ppt.	Ppt.
Hydrochloric acid	Cloudy	No ppt.
Nitric acid	Cloudy	No ppt.
Sulphuric acid	Cloudy	No ppt.
Basic lead acetate	Ppt.	No ppt.
Aluminum sulphate	No ppt.	No ppt.
Acetic acid	No ppt.	No ppt.
Mercuric chloride	Ppt.	No ppt.
Mercuric sulphate	Ppt.	No ppt.
Mercurous nitrate	Ppt.	Ppt.
Lead plumbite	Ppt., brown on boiling	No ppt. or color

R. Bauer, *Z. Physiol. Chem. 35*, 343 (1902), found that on heating horn shavings at 150 to 200 deg. Cent. with water in sealed tubes for twenty-four hours a considerable amount of hydrogen sulphide and another volatile sulphur compound, presumably methyl mercaptan, were formed. The solution contained compounds corresponding to Neumeister's atmidalbumin and atmidalbuminose (cf. *Z. Biol. 23*, 381-401, and subsequent years) and Bauer designates these atmidkeratin and atmidkeratose. The turbid aqueous solution does not gelatinize on cooling, and on evaporation he obtained a residue insoluble in water.

Heiduschka and Komm, *Z. Physiol. Chem. 121*, 221 (1922); *124*, 37 (1922); and *126*, 130 and 261 (1923), investigated the action of water on horn clippings under various conditions and found that the initial temperature of partial degradation varies with the time of heating and the conditions of the experiment. Among the volatile products of decomposition are hydrogen sulphide, ammonia and sulphur compounds.

The Action of Acids

As a class, the keratins are insoluble in very dilute acids, Lloyd, *loc. cit.*, says that they are not even swollen in cold dilute acids. This fact is undoubtedly closely related to the isoelectric point of the keratins, and very probably the hydrogen ion concentration of the acid solutions above referred to is in the vicinity of pH 4.8. As the strength of the acid solution increases, the keratins dissolve more or less completely. Swelling takes place in the cold but the solution is effected on boiling. Horny substances swell in cold glacial acetic acid and on boiling are largely dissolved. Whalebone is converted into a gelatinous substance by boiling with concentrated acetic acid, while tortoise shell is very little changed by the same treatment.

Sulphuric acid seems to be best suited for the decomposition of the keratins, for although hydrochloric acid attacks most of them, hair remains unaffected even by fuming hydrochloric acid. Fuming hydrochloric acid swells most keratins to a jelly and they subsequently dissolve. The acid solution appears to contain syntonin, for on dilution with water and the addition of potassium ferrocyanide, it gives a flocculent precipitate; it also gives a white flocculent precipitate when exactly neutralized.

N. Zelinsky, *Chem. Z. 36*, 824 (1914), has suggested formic acid as a hydrolyzing agent for the proteins and claims that its action is much more rapid than that of boiling hydrochloric acid.

Menschell, *Arch. exptl. Path. Pharm. 110*, 1-45 (1925), reports that on human hair it requires considerable time for twice normal acid solutions to have any noticeable effect. The effects of acids of the chloro acetic series is related to their chemical constitution, while inorganic acids in a twice normal solution causes changes, after three weeks exposure, comparable to this of trichloroacetic acid. Nitric acid is most active. Salicylic acid in a saturated solution has no effect on the mechanical properties of hair. A disintegrating effect occurs when hair is placed in an atmosphere of pure hydrogen sulphide. In twice normal acetic acid pieces of human epidermis, which also contains keratin, undergo a typical change, a retocytolysis, i. e., a swelling and peptization of the rete Malpighii. Peptization of the rete Malpighii proceeds very quickly in twice normal acetic acid and is complete in forty-eight hours. Acetic acid swells the albumoses of the horny layer of human skin very actively, but does not modify the keratin substances. The occurrence of retecytolysis is in part dependent on the mechanical properties of the skin. Inorganic acids penetrate the rete Malpighii and cause more or less localized areas of swelling in the stratum corneus, while formic, acetic, butyric and lactic acids induce a diffuse swelling. The changes in the albumoses of the cornified material result in alterations in the elastic structure of the skin. With other acids, more or less destructive changes occur. Retecytolysis of pieces of human skin occurs on both the acid and alkaline sides, the behavior of different acids manifesting certain specific effects.

Wilson, *Ind. Eng. Chem. 18*, 47-50 (1926), states that "in solutions 3 *N* or stronger, hydrochloric acid is more

active (in the destruction of leather) than sulphuric acid, while in weaker solutions the reverse is true. The greater activity of sulphuric acid in the weaker solutions seems to be due to its greater detannizing power. The more powerful destructive action of hydrochloric acid in stronger solutions may be due to the fact that it is a stronger acid than sulphuric or it may be the result of the specific action of the chlorine ion, which Wilson has found to be very destructive to protein matter in concentrated solution, even at the point of neutrality, while sulphates appear to have a preservative action."

Alkalies

The action of the alkalies upon the keratins, all of which contain sulphur, is well known and was mentioned in various places in the previous papers, particularly in connection with its action on the sulphur in wool.* Upon treating the keratins with alkalies, a certain portion of the sulphur is removed, the amount depending upon a variety of conditions.

Smith, *J. Chem. Soc. 46,* 1398 (1884), states that as a class the keratins are not affected by alkalies until the concentration becomes rather high, but that in 20 per cent solutions of alkali the keratins swell and dissolve on boiling. Ammonia is less effective in this way than the fixed alkalies but acts in the same manner. It is well known, as pointed out by Dreaper, "Allen's Commercial Organic Analysis," 4th Edition (1913), Vol. VIII, page 675, that on acidification of this alkaline keratin solution, a white flocculent precipitate is formed and hydrogen sulphide is evolved. Horn is dissolved on boiling with sodium hydroxide solution, and the acidulated solution gives reactions similar to those of wool. Human epidermis is only partially dissolved by the boiling caustic solution, but the acidulated solution gives precipitates with the acid dyestuffs, in the same manner as wool and horn.

In the case of wool, sodium hydroxide solutions of 5 to 60 deg. Tw. (Sp. Gr. 1.025 to 1.30; 2.3 to 27 per cent NaOH) rapidly disintegrate the fiber. When wet with this alkaline solution the wool can be drawn out to nearly twice its normal length, and on drying is felted. Sodium hydroxide of 70 to 100 deg. Tw. (Sp. Gr. 1.35 to 1.50; 31.7 to 46.2 per cent NaOH) causes no felting in wool and under the proper conditions may even increase the strength of the fiber. According to Washburn, *J. Soc. Dyers and Colourists 17,* 261 (1901), and Matthews, *J. Soc. Dyers and Colourists 18,* 207 (1902), the maximum increase in tensile strength is obtained on treating the fiber with an 82 deg. Tw. (Sp. Gr. 1.410; 37.47 per cent NaOH) solution.

S. Sakaguchi, *J. Biochem. (Japan) 5,* 143-57 (1925), found that arginine-free protein can be prepared by treating the protein with sodium hypochlorite in the presence of an excess of free alkali. The excess of sodium hypochlorite is apparently without any effect. Later, *J. Biochem (Japan) 5,* 159-69 (1925), he reports that the guanidine portion of the arginine in protein is less easily detached by the action of alkali on the protein than on the free amino acid. Arginine in gelatin is more easily attacked than in other proteins, which may be due to the fact that guanidine is readily hydrolyzed from this protein, or that gelatin under the action of alkali breaks up into peptides of much smaller size. The guanidine is completely removed from the arginine of several proteins acted upon by alkali while the peptide linkage of the protein molecule itself remains unaffected.

Among practical wool men there has long been an idea that the action of the alkaline detergents containing potassium are much less injurious than those with a sodium base. We frequently find that some of these old ideas have a real basis in fact, although we are unable to give a theoretical explanation. However, in the case of wool, it is well known that the naturally occurring alkali in the fiber is potassium. Wertheimer, *Arch. ges. Physiol. 208,* 669-83 (1925), found that when fog membrane is immersed in isotonic solutions of the chlorides of sodium, potassium, lithium, ammonium, and some of the rarer alkalies, potassium chloride swells the inner side of the membrane, with aqueous absorption, but has only a very slight action on the outside. Sodium chloride exerts just the opposite effects, while ammonium chloride has approximately the same action upon both sides of the skin. When compared in this way, the chlorides of the alkalies may be arranged in the following order: Potassium, rubidium, caesium, ammonium, lithium and sodium. In the same manner a 0.01 *N* sodium hydroxide solution causes the outer surface of the membrane to swell while the inner surface is but slightly affected. But in a 0.01 *N* sulphuric acid solution, the action is reversed and the inner surface swells while the outer surface is only slightly affected.

According to H. Menschel, *Arch. exptl. Path. Pharm. 110,* 1-45 (1925), an increase in volume of some 25 to 30 per cent occurs when human nails (keratin) imbibe water. Within the pH zone of 1 to 11.5 the swelling does not exceed that which takes place in distilled water, but when the pH reaches 12.3 to 13 or above, there is a marked increase in swelling. In this case neither organic nor inorganic acids increase the swelling beyond that induced by distilled water. The fixed alkalies, sodium and potassium hydroxides, in normal and twice normal concentrations, induce a maximum swelling and this is followed by a prompt peptization.

The action of twice normal alkali solutions is more rapid than that of a normal solution, as would be expected, but ammonium hydroxide is not active at these concentrations. A saturated solution of calcium hydroxide has but a slight swelling effect and no peptization appears to take place.

M. also reports that while distilled water causes but little swelling of human hair even on three weeks' soaking, normal and twice normal solutions of sodium or

*See American Dyestuff Reporter, 15, 501-3 (1926).

potassium hydroxide cause a very marked action. The action of twice normal ammonia solution is considerably less. Retecytolysis, i. e., a swelling and peptization of human skin occurs on both the acid and alkaline sides. Alkalies in twice normal concentration penetrate the rete Malpighii quickly, causing a swelling and prompt peptization which is complete. The characteristic feature of the action of alkali is an actual keratolysis. Alkali also causes a marked swelling of the albumoses of the horny layer of skin and the elastic structure of the epidermis is destroyed. Ammonia in twice normal concentration does not cause such a pronounced effect. The effects of alkali are reversible. Distilled water does not cause the albumoses of the cornified layer to swell.

Wilson and Daub, *Ind. Eng. Chem. 16*, 602-3 (1924), found that on soaking calf skin in sterile lime water at 20 deg. Cent. (67 deg. Fahr.) the first effect was a slow disintegration of the Malpighian layer of the epidermis, so that at the end of five days the hair and epidermis could easily be removed by scraping with a blunt knife. After three weeks the sebaceous glands were attacked and nearly all the epidermal cells surrounding the hairs had disappeared, leaving the hair resting loosely in the empty follicle. The elastin fibers broke down rapidly after the fourth week and at the end of the fifth week had entirely disappeared. Many cell nuclei were still to be seen after five weeks but were gradually destroyed and after three months none were found. The corneous layer of the epidermis and the hair appeared quite resistant to the action of lime for eighteen weeks, but began to disintegrate slowly after this time and had disappeared by the end of seven months. The collagen fibers assumed a blurred and glassy appearance after five months.

According to Wilson and Merrill, *Ind. Eng. Chem. 18*, 185-8 (1926), when skins are limed before tanning, the keratins are partially hydrolyzed into keratose, which is soluble in neutral or alkaline solution, but is precipitated at its isoelectric point, pH 4.1. Very probably this reaction also takes place in the presence of lime in the depilitation of skins.

Lloyd, *loc. cit.*, page 189, says that although the keratins do not swell in dilute acid solutions, they do swell in alkaline solutions. She is not sure whether this swelling is an osmotic phenomenon, similar to the alkaline swelling of gelatin, or whether it is the first stage of solutions and hydrolysis by the alkali. Undoubtedly the presence of the alkali greatly increases the solubility of the water in the keratin.

(This is the ninth paper of a series on "Wool" by Mr. Mullin. The second half of this paper, dealing further with the action of various chemicals on the keratins as a class will appear in the next issue.)

September 27 marked the completion of the thirty-first year of the Lowell Textile School. President Eames made a brief address of welcome on that date to the freshman class of 1930, and said that official registration figures would be given out later.

DRY CLEANERS REVIEW PROBLEMS

After a very satisfactory meeting, during which the major technical problems to be overcome in dry-cleaning practice were outlined, the conference called by the National Association of Cleaners and Dyers of the United States and Canada adjourned at the Hotel Pennsylvania in New York on September 27, with the prospect of holding another conference in a few weeks. Those who attended represented thirty associations comprising members of the apparel trades, advertising men, Government representatives from the Textile Division, Department of Commerce, the Bureau of Standards and the U. S. Department of Commerce, laundry owners and research technologists.

Discussion of the troubles which the cleaners seek to eliminate, in the interests of allied textile trades as well as for their own benefit, centered about the results of manufacturing garments which will not stand dry-cleaning and laundering. Considerable damage blamed on dry-cleaning practice, it was said, is actually brought about through faulty manufacture and through neglect to consider the effects of cleaning. Representatives of the apparel trades offered their co-operation.

To assist the apparel men, a booklet, "Some Standard Practices for Cleansing," was distributed. This outlines various dry-cleaning processes in detail and enumerates specifications for testing fabrics to see if they can be cleaned, with the recommendation that these tests be insisted on by the apparel men and the retailer. These specifications were commented on favorably by Dr. W. F. Edwards, of the United States Testing Laboratories.

Attention was also called to Bulletin 322 of the Bureau of Standards of the Department of Commerce, which deals with the effect of dry-cleaning on silks.

SOUTHERN TEXTILE SHOW WILL HAVE CLUB

The following committee has been appointed to arrange the clubroom for presidents, superintendents, office men, overseers and others who will visit the Southern Textile Exposition, November 1 to 6: Austin Parker, chairman; Earle Stall, W. H. Hudgens, D. Byrd Miller and Walter W. Gayle.

This clubroom will be one of the attractions of the exposition. This will be the men's smoking and lounging room. It will be equipped with desks, tables, comfortable chairs, magazines, newspapers and telephones. Daily market reports will be shown.

Visiting executives, superintendents, overseers, section men, office associates and all others having direction of the affairs of any kind of manufacturing or other industrial plants will be welcome.

The clubroom will also be official headquarters for the Southern Textile Association. The secretary, J. M. Gregg, will have a desk there. All members are invited to make the clubroom their headquarters.

Investigation on the Influence of the Aftertreatment on the Fastness to Light of the Naphthol AS Combinations

A Communication from the Naphthol AS Experimental Laboratory of the I. G. Farbenindustrie Aktiengesellschafft, Offenbach, a.M.

By DR. E. KAYSER

(Translated from the Melliand Textil-Berichte by Carl Toepler)

THE work of Dr. Loechner has shown (Melliand Textil-Berichte, No. 3, 1926) that the light fastness of Naphthol AS dyeings is considerably increased by a boiling soap treatment. The experiments show that adhering naphthol or base residues have no effect on the light fastness.

The question arose, as Dr. Haller was speaking before the Tenth Congress of the International Association of Chemists and Colorists at Zurich in May, 1925, on the "Action of Temperature and Pressure on the Position of the Dyestuff Particles Within the Fiber," if not similar phenomena occurred with the Naphthol AS combinations; and if so, how can we come to a definite conclusion on the fastness to light of the dyeings, from the deposits of crystals within the fiber.

Before studying the dyed cotton let us consider the photomicrograph of an undyed cotton fiber (Fig. 1). The micrograph (2500 x) permits us to observe the following details on the fiber:

1. The cuticle or outer surface.
2. The cell wall or cell membrane.
3. The "lumen," or the inner hollow space.

The cell wall consists of pure cellulose and composes about one-third of the diameter of the fiber, while the "lumen," filled with air for the greater part, composes the other two-thirds.

Our exhaustive experiments with the Naphthol AS combinations on the fiber have shown that the color lake in unaftertreated dyeings is in the cell wall, while the color lake of dyeings rinsed hot or soaped at the boil is in the "lumen" of the fiber.

One combination that is especially suitable for these experiments, as it will withstand a long boiling and produce an apparent color change, is Naphthol AS-SW (Fast Red KB Base). Fig. 2 shows a micrograph of a dyeing of this combination merely given a cold rinse. The color lake is uniformly distributed in the cellulose or cell walls, and with strong magnification (4000 x) the single, small color particles are perceptible. The exterior of the fiber is a yellowish red. If this dyeing is treated for half an hour in a soap bath at a boiling temperature, a change in the deposit of color is noticed. The cell wall contains only a small amount of the color lake, and in polarized light very small, uniformly deposited dyestuff crystals can be observed whose size is less than 1/10 mu. The chief deposit of color is found in the inner wall of the "lumen." At the same time a more or less heavy accumulation of crystals can be observed in the lumen itself. Fig. 3 (2500 x mag.) shows a Naphthol AS-SW (Fast Red KB Base) dyeing soaped boiling hot with a clearly noticeable accumulation of dyestuff. Occasionally definitely formed crystals are found in the lumen, as shown in Fig. 4 (3500 x mag.). Fig. 5 shows a dyeing of Naphthol AS-SW (Fast Red KB Base) on mercerized yarn soaped boiling hot. Due to the mercerization, the corkscrew-shaped spirals are absent, so that it can be observed more closely.

We are, however, in a position to observe the deposits of crystals even in unmercerized cotton, and the well-known copper oxide-ammonia reaction on cotton furnishes a medium for this. Certain concentrations of the copper oxide-ammonia reagent do not lead to the complete destruction of the cellulose, but instead cause the cell walls to swell to such an extent that it consists of two-thirds of the diameter of the fiber, while the lumen consists of the other one-third. Only rinsed dyeings show a copious deposit of color in the cellulose; on the other hand, in the case of dyeings soaped at the boil the bulk of the color lake is the lumen.

We made the observation that the deposit of color lake takes place mostly on the layers nearest the lumen, which are permeated with dried protoplasm residues. The observation of Haller (Zeitschr. Farben, 1907), that protein substances are able to store up dyestuffs, is confirmed still further. We can therefore assume that by the aftertreatment in a boiling soap bath a migration of the dyestuff particles toward the interior takes place, and at the same time a change in color to a bluish red occurs. An aftertreatment in water alone has a much lesser action on the deposition of the dyestuff and the shade. However, if an addition of alkali is made to the water the same effect is obtained. In order to ascertain if this migration was entirely due to temperature, we made increasing additions of common salt to the soap bath. The migration of the dyestuff particles diminished with increasing amounts of common salt. The color change of the dyeing of Naphthol AS-SW (Fast Red KB Base) was also much less as the amount of salt in the soap bath was increased.

PLATE I.

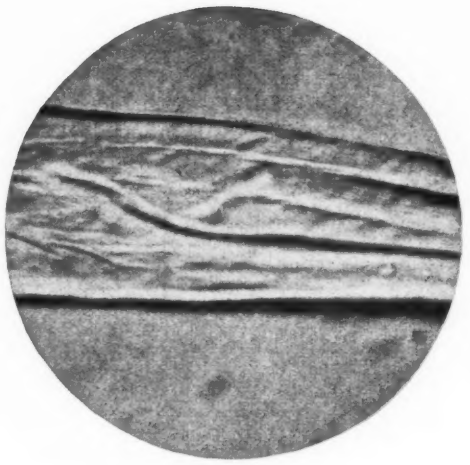

FIG. 1

1. Cuticle.
2. Cellulose.
3. Lumen

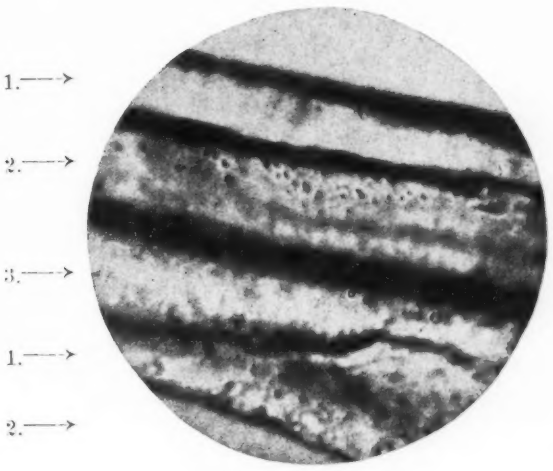

FIG. 2

1. Cuticle.
2. Cellulose with color lake.
3. Lumen.

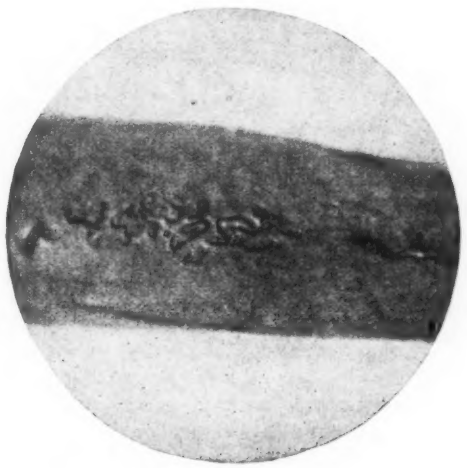

FIG. 3

1. Color lake in lumen.

FIG. 4

1. Cellulose.
2. Dyestuff crystals in lumen.

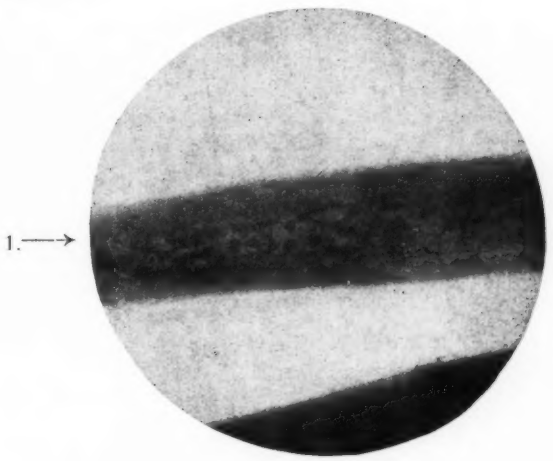

FIG. 5

1. Color lake in lumen.

With a nearly saturated salt solution and a temperature of 109 deg. Cent., the change in shade was no different than that of a dyeing merely given a rinse. It appears to us that the migration of the color particles from the cell walls to the inner part of the fiber is closely dependent on the swelling of the fiber. This swelling is very small with an after-treatment in boiling water, and the maximum is reached by a treatment with alkali or upon treating with a boiling soap solution. If an addition of common salt is made, the swelling is prevented, a migration of the color lake does not take place, and no change in shade occurs.

The migration of the color particles is closely connected with the change in the light fastness. Fading tests made with rinsed dyeings gave poor results, while dyeings aftertreated in a boiling soap bath possessed good fastness to light. With the migration of the color lake toward the inner part of the fiber, an increase in the light fastness takes place. This increase in the fastness to light can perhaps be explained by the fact that the dyestuff upon aftertreatment forms larger aggregates and in the inner part of the fiber is also more protected. These phenomena of the migration of the particles of color and the closely allied increase in light fastness have also been observed in the other Naphthol AS combinations investigated. With most of the Naphthol AS combinations a considerable change in shade occurs along with the increase in fastness to light due to the aftertreatment. It cannot be assumed that a change in the constitution of the dyestuff has taken place, as it is plainly a physical-optical phenomenon, closely connected with the size of the dyestuff particles.

The original article is accompanied by a photograph of a light exposure of dyeings aftertreated in various ways. Two combinations are shown: Naphthol AS (Fast Red G Base) and Naphthol AS-SW (Fast Red KB Base). The dyeings have been: (1) Rinsed cold; (2) rinsed cold, followed by a five-minute rinse at 50 deg. Cent.; (3) rinsed cold, rinsed five minutes at 50 deg., soaped half an hour at 75 deg. Cent., and finally rinsed cold; and (4) rinsed cold, rinsed five minutes at 50 deg., soaped half an hour at the boil and finally rinsed cold. The least fast to light dyeings are those given a rinse, while the fastest to light are those soaped at the boil.

Conclusion

Microscopic investigations of the Naphthol AS combinations show that by certain aftertreatments a migration of the dyestuff particles toward the inner part of the fiber takes place. The difference in the light fastness of an untreated dyeing and one soaped boiling hot is explained by these migration phenomena.

The Dyeing of Worn Garments and Redyeing of New Materials

Preliminary Treatment—Silk and Mixtures—Other Materials—Damaged Goods

By PAUL SCHUTZE

(*In Deutsche Farber-Zeitung*, 1926, *pages* 652-653)

(Translated by Albert P. Sachs, Universal Trade Press Syndicate)

IN this article we shall consider certain important points in the dyeing of worn garments and the dyeing or redyeing of new materials based on my own practical experience.

The preliminary treatment of worn garments consists primarily of a thorough cleansing. For this purpose the garments are immersed in a lukewarm soda bath with the addition of some novokarnit, which has a fat-dissolving action, does not damage wool and renders the preliminary washing decidedly easier. Thorough brushing of most articles is necessary to increase the levelness of dyeing. Lighter shades require a very thorough preliminary treatment, and many higher grade articles require a treatment in a lukewarm soap bath. Certain stains must be removed by bleaching. For this purpose the goods, after a thorough preliminary rinsing, are treated in a bath with burmol or, better still, with hydralit; the goods are entered lukewarm, and then the temperature is raised to boiling. The acid for the hydralit bath is added in two portions. The stripping or the bleaching which may prove necessary is carried out in sufficiently large wooden vats. During the stripping of the dyestuff and the bleaching of the stains the goods should be moved about. After rinsing thoroughly and boiling in a clean bath of Glauber salt, practically all traces of the stripping material should be removed and the dyeing may be commenced. Stripped garments must be carefully dyed; if acid dyes are used, start with a weakly acid bath, add the dye in two portions and the remainder of the acid gradually. Operate lukewarm and heat only very little.

Silk and Mixtures

Silk requires a careful and thorough treatment. Wool-silk mixtures are brushed with lukewarm castile soap, rinsed in a soda bath, then rinsed in warm water, and then in cold, and finally dyed in an acid bath for the production of the best shade. Pure silk, after the brushing, is treated in a boiling-hot castile soap bath made up with soft water for ten minutes and then rinsed. Stained garments are then immersed in a hydrogen peroxide bath, and then drawn through a lukewarm sulphuric acid bath. Colored silk stripped with burmol but still showing stains is also treated with hydrogen peroxide after the burmol is thoroughly removed.

More delicate garments of silk and wool may also be chemically cleansed; wool is then brushed with clean water to remove adhering stains, and dyed immediately. Sometimes good results are obtained by direct dyeing. Chemical cleansing of silk to be dyed in light shades removes obstinate grease stains and simplifies the preliminary treatment.

Cotton, linen, awning materials, etc., are washed by boiling in soda; colored and stained materials are stripped with hydralit, rinsed and then bleached with lukewarm chlorine water for twenty minutes with good stirring. After bleaching, the goods are rinsed, acidified hot, rinsed, neutralized and again rinsed. The dyeing is then carried out with direct dyes or with basic dyes on a tannin-tartar emetic mordant or with indanthrene dyestuffs.

Woolen goods from which the original color must be removed are first treated lukewarm for an hour in a strong soda bath; it is best to add some protectol to protect the wool against damage by the soda. After thorough rinsing there follows a treatment for ten to fifteen minutes in almost boiling-hot solution of ammonia. In most cases the wool will be stripped sufficiently. In special cases where the dye requires it, stripping is carried out with hydralit.

Other Fabrics

Furniture fabrics, plush table coverings, etc., are treated similarly, but with mild and short preliminary treatments in order to protect the fibers. Dyeing is with acid dyes; only part of the dyestuff and acid is used, the goods are entered lukewarm, raised to the boiling temperature, and the remainder of the dyestuff and acid is added gradually and the dyeing finished quickly; actual boiling is avoided in such cases. Adding egalisal or novokarnit is recommended to prevent damage to the wool and to assist in level dyeing. Golf sweaters in light shades are treated after a careful washing in hydrogen peroxide, followed by a light acid treatment; better dyeings are thus obtained. Stains of resin or stearin are removed with alcohol; those from lubricating oils, tar and oil colors by the use of trichlorethylene or ethyl acetate. Objects with strong paint stains are treated by rubbing in soft soap while the goods are wet, allowing to soak overnight and then brushing cautiously with soda; after thorough rinsing the dyeing can be carried out. Wool is dyed in an acid bath, the dyestuff being added completely dissolved to the acidified bath and carefully raised to the boil. The bath is then cooled to 60 deg. Cent. The goods are entered and the bath raised to the boil, and the rest of the acid is added. The dyeing takes three-quarters of an hour with moderate boiling, a full hour for black. Careful moving of the goods is necessary. Plush requires extremely careful handling and the dyeing process should be brief. Cotton seams, after rinsing, neutralizing and repeating rinsing, are dyed by painting with lukewarm cotton dyestuffs with the addition of Katanol W. Katanol W accelerates the absorption of dyestuff by cotton and hinders dyeing of the wool. Good results are also obtained with acid dyestuffs in a neutral bath after a thorough preliminary cleansing. The dye manufacturers furnish the garment dyer with a comprehensive selection of dyes so that excellent results can be obtained with any desired type of dyeing. For neutral dyeing enter at 60 deg. Cent.; do not add too much Glauber salt, but add some novokarnit. It improves the dyeing and the novokarnit also assists in exhausting the bath. Raise to the boil gradually, but do not boil. The dyeing is complete in three-quarters of an hour; for black, one hour.

Damaged Goods

Damaged new goods, made up or in the piece, of silk, wool and silk, wool or union goods which are to be dyed in other shades and are to be sold again as new, require very careful preliminary treatment. After a light soda wash, the goods are rinsed. The dyeing may be acid, basic or neutral. After the dyeing the goods are carefully rinsed, the pieces stretched to retain the merchant finish. Checked goods are first dyed mildly with a little dyestuff in order to gradually mask the checks as the dye is added; in this way the design disappears entirely. After rinsing, the goods are treated in an acetic acid bath. Silk chiffon and wool voile must be dyed below the boiling temperature, as otherwise the weave warps. By carefully following the above directions success is assured.

INTERESTING BOOKLETS ON DYEING

The Franklin Process Company has published several very interesting little booklets treating of various phases of dyeing, explaining the classes of dyes, the services of the company to converters, brokers, etc. The titles of the first four of these booklets in their order are: "Franklin Process, Its Service to Brokers and Creators of Textile Fabrics"; "The 'Cinderella' of the Textile Industry"; "Some Misconceptions and the Truth About Dyes and the Dyeing Industry"; "Dyes and Their Properties."

Each booklet deals with its subject concisely and in a readable manner, presenting the simple facts in a form easily understood by the layman and general student of dyeing. They should help to clear up some of the so-called mysteries of dyeing.

The Cause of Faults in Piece Dyeing

Insufficient Steaming—Faulty Decatizing—Heat Creases—Poor Preparation—Mildew—Stripping

By J. STEPHEN HEUTHWAITE

IN the present article I shall endeavor to describe the most frequent mistakes in piece dyeing, their cause, and also methods for their prevention and correction, which I have learned purely by experience. If different pieces of one lot, or batch, vary in color so that some places appear lighter than others, the cause is often to be found in the fact that the various pieces contain different qualities of material, i. e., that different kinds of wool have been used for their manufacture, or, if they do contain the same blend, or mixture, of wool, that they have been subjected to varying preparatory treatments which have altered their capability for taking up color. Especially does a slower or quicker milling process influence the capability for taking up different mordants and dyestuffs. In a still greater degree decatizing may cause differences, according as to whether it has been carried out with dry or wet steam, or for a longer or shorter time.

These differences can be very rarely accounted for by mistakes in the dyehouse. When this is the case, however, it is generally due to the faulty construction of the dye cisterns. For instance, if the liquor is brought to the boil more quickly, and boiled more rapidly on one side of the vat than the other, and the pieces are worked therein in several draughts close together, the piece which runs where the bath boils more rapidly will dye darker. This mistake may be avoided by continually changing the position of each batch of cloth, and, better still, by improving the heating arrangement. This variation in shade may also be produced by dyeing batches of varying lengths—the larger batches turn out lighter in shade than the shorter ones when the two are dyed at the same time. Whatever the cause of the variation in shade, it may easily be determined in most cases. If the mistake is occasioned in the wool milling or in the preparatory treatments, the pieces in one and the same batch will vary in shade; if the mistake arises in the dyehouse, the various pieces of the one draught will correspond with each other, but will differ from those of another draught.

Insufficient Steaming

It often happens that the two ends of a piece appear darker and lighter respectively. This fault is frequently caused on the decatizing rollers by insufficient decatizing. The inner layers of the piece which lie immediately on the decatizing cylinder receive an increased affinity for mordants and dyestuffs, because, during the steaming they are more exposed to the action of the steam than are the outside layers. This defect is generally caused by insufficient steaming, and is usually perceived before the dyeing, the ends of the pieces being somewhat darker in color. Darker ends may be caused in mordanting and dyeing by careless manipulation, when, in stitching the ends together, the one end of the piece is allowed to dip into the ready prepared mordant or dye liquid for some time before the whole piece has been run through the liquor. The dark places thus produced are to be easily distinguished from those due to inefficient decatizing through the sharp outlines in the darker shade.

Dark lists are a frequently occurring mishap. In most cases they are caused in the preparatory treatment of the goods by allowing the pieces to hang over trestles while in a wet state during or between the operations of scouring, milling, or neutralizing after carbonizing. The pieces should never be allowed to hang for a long time, especially when they are saturated with washing lyes, soda, and similar alkaline ingredients. Such hanging, even when saturated with water only, is also to be avoided, because the draining of the liquid always changes the affinity of the wool to the dyestuffs at the lists.

Dark lists may also be caused in the dyehouse if the goods after mordanting, and while still containing mordant drains off towards lists, where thus the surplus mordant becomes fixed, and afterwards darker shades are produced. Darker colored lists, due to the same cause, may also be produced in dyeing with mordant and chrome developing colors. It is advisable, therefore, to always wash the goods immediately after mordanting or dyeing.

Faulty Decatizing

Also, in the above-named cases the goods should not be allowed to lie in an unrinsed condition. If, in cases of necessity, the pieces are to be allowed to lie for some time, they should be plaited down at full width, and evenly, on a table or flat scray. Dark lists in milled goods may often be caused in the weaving process, viz., when the lists are too loosely woven, and, after the milling of the piece, appear more open than the main body of the piece. Finally, dark lists are often occasioned by falty decatizing. If the pieces are not evenly wound onto the cylinders throughout the total breadth, so that there is less resistance to the steam at the lists, a stronger decatizing action will eventually take place at these points, which is accompanied by an increased affinity of the wool mordants and dyestuffs.

Light lists are often produced by a similar cause to

those producing dark lists. For instance, if goods which are intended for carbonizing are allowed to lie over trestles, etc., after impregnating with acid and hydro-extracting, the acid becomes more concentrated towards the lists, and, consequently, decreases the affinity of the material for dyestuffs during the subsequent dyeing. Another cause of light lists is to be found in the fact that when dyed in the rope form some materials have a tendency to curl inwards, when naturally the lists get insufficiently penetrated. This difficulty is overcome by stitching the lists together so that the pieces form long tubes, and dyeing in this manner.

Discolored stripes, running exactly in the direction of weft or warp, are invariably produced in weaving. They are accounted for by the use of different qualities of yarn, or by the fact that the pieces are woven more closely or more loosely at these points. Singeing stripes also run almost exactly in the direction of the warps. They may be recognized by examining the nap of the goods, which is shorter here than at other places. Uneven longitudinal stripes, showing verying depth of shade, often arise in milling. They are due to the formation of the so-called milling creases, when the goods become too hot or run too dry.

Heat Creases

A similar fault may arise in the dyeing process, in which case the stripes are called heat creases. They are produced by dyeing in insufficiently acidified baths, especially when the goods are wound onto the winch, or thrown over trestles, etc., and allowed to remain there for some time in an uncooled condition. Heat creases are also easily formed during dyeing when the pieces are too tightly sewn together. In this case these faults begin at the seams and gradually trail off. Heat and milling creases are very similar in appearance. The latter may be very readily recognized, however, as on examination it will be seen that the wool fibers have been felted along the creases.

Cloudy, uneven shades may be caused either in the dyeing or preparatory operations. They are easily formed during dyeing if the goods are entered into the mordant or dye baths wetted unevenly and insufficiently, or without previously being wetted out at all. Cloudy shades are further produced by the careless addition of dyestuff, mordant, or developing salts, i. e., by not sufficiently reducing the temperature of the bath before making any subsequent additions. Furthermore, colors which do not equalize well are apt to yield uneven and cloudy results if the baths are heated up too rapidly, or if they contain too much acid. Alizarine and chrome developed colors are best thoroughly boiled with oxalic acid as soon as possible. This will often remedy unevenness. On the other hand, acid dyed shades may be corrected by boiling the goods in a neutral bath with water only, with the addition of Glauber salt. Another method is to strip the goods by boiling them in a warm bath at 100 to 120 deg. Fahr., with the addition of soda, ammonia, or ammonium carbonate. This method, however, must only be resorted to where others have failed, since the quality of the material is always somewhat impaired by it. A better method is based on the application of hydrosulphite. Contrary to the above mentioned alkaline ingredients, hydrosulphite does not impair the quality.

Bad Preparation

Cloudy, uneven results are far more frequently caused by bad preparation of the goods than in the dyeing. These faults can very often be traced back to the faulty cleansing of the wool. Attention has already been drawn to these defects in the description of the various preparatory treatments. They are due to the presence of fats or lime soaps which are left in, or formed within, the pieces by faulty scouring, inefficient washing after scouring, milling and decarbonizing. All these faults have been dealt with when dealing with the treatment of wool before dyeing.

Clear, well-defined spots, and dark stains may be due either to faulty preparing or faulty dyeing. Spots are produced when goods which have been impregnated with acid for carbonizing and hydro-extracted become sprinkled with water or drops of soap or soda solution. Also through handling them with wet hands or allowing them to get dry in odd places. Spots which appear in regular intervals in about the same position are generally to be traced to be oil drops falling from the shafting onto the pieces during weaving.

Dark stains and color spots are produced if the dyestuffs have not been properly dissolved, or if dirty water has been used for making up the solutions. Very calcareous water is liable to cause lime salts to be precipitated in heating up the bath, which, in settling, sometimes precipitates particles of dyestuffs also upon goods. It is, therefore, highly desirable to use clean and purified water.

Effect of Mildew

Difficulties are caused frequently by mildew. These stains appear lighter, and in carded goods as bare spots. They are due to fungi which grow, under suitable conditions, in the pieces if these are left lying in a wet state for some time. These mildew stains are most common in indigo blues dyed in the fermentation vat, and cannot be rectified. It is therefore imperative to obviate their formation by attention and cleanliness. These fungi frequently start culture in the cracks and crevices of the wooden scrays and horses on which the wet pieces are placed, hence, in many dyehouses, all these utensils are covered with zinc.

Speckled or seedy results, on the other hand, are always exclusively accounted for by faulty manipulation in dyeing and by faulty selected colors. Although sometimes

the material contains wool blends which incline towards this defect, still an experienced dyer will mostly be able to overcome the difficulty by selecting the proper dyestuffs and by regulating the dyeing operations accordingly.

Some woolen piece goods, especially the better qualities, frequently have a tendency to become lighter at those places which are exposed to wear and tear in practical use. For instance, at the buttonholes, seams, etc. Although seemingly due to bad penetration, the reason for this fault must be looked for in quite a different direction. This can easily be proved by treating the faulty places with solvents, when the lighter parts will quickly assume their regular aspect in consonance with the rest of the material.

The real cause of the defect of becoming lighter lies in the abnormally high percentage of fatty matter in the goods. These fatty substances may be due to bad wool washing, or to faulty removal of the lubricants used in stripping and weaving. The various operations of carbonizing and dyeing free from the fatty acids, which, in rinsing, become fixed as in soluble lime salts. These fatty compounds are apt to make the cloth shiny under the influence of pressure or continued wear, and, as the light rays are reflected from them they will appear, looked at from afar, rather lighter. Examined closely, however—overhand—these lighter places disappear, and therefore it is clear that the fault cannot be due to bad dyeing. In fact, these drawbacks are perceptible neither in dyeing nor in making up the garments. They only show themselves in weaving.

Stripping

In order to obviate this disagreeable effect it is necessary to watch the scouring process most carefully and to ascertain that all fatty matter and grease is thoroughly got rid of both in scouring and in rinsing, so that no lime salts can be precipitated upon the fiber. Another defect shows perceptibly when, in passing finger nails on any hard object over the goods, light marks appear. This is generally due to the superficial fixation or a too concentrated application of finishing ingredients.

If the pieces are dyed more deeply than was required, this mistake can be corrected in various ways. In cases where the goods have been dyed with equalizing acid colors only, it will be sufficient to boil them (if necessary with another white piece) in a bath containing Glauber salt only, and sometimes 5 per cent of acetate of ammonia, or 1 per cent of ammonia added to it.

Colors, however, which are liable to go into the fiber very rapidly, and therefore are dyed with acetic acid or other milder additions, cannot be stripped so easily. In this case hydrosulphite is used. The bath is prepared with 5 per cent hydrosulphite and 3 per cent acetic acid or 1.5 per cent of formic acid; the goods are entered lukewarm, the temperature gradually raised to the boil and the pieces stripped by boiling for half an hour. Finally, they are well rinsed. Hydrosulphite can, of course, be used for stripping the equalizing colors as well, with the exception of indigo carmine. The other chrome developing and mordant colors are generally not affected by hydrosulphite. If, therefore, the shades are too dark it is necessary to treat the goods in a warm bath with Glauber salt and oxalic or sulphuric acid in order to partially split up the color lake.—Dyer and Calico Printer.

PRATT ALUMNI OUTING

"It was a lively day, and then some," was the unanimous comment on the very successful annual outing of the Pratt Institute Chemical Alumni Association held at Fuhrer's American House, College Point, Long Island, on Saturday, September 11.

The size of the crowd that came into College Point by train and automobile on the afternoon of the outing was more than gratifying to the outing committee. When all was over, the committee received enthusiastic and unanimous congratulations on its excellent judgment in planning the events of the day. With ideal weather, two well-matched ball teams, abundant refreshments and a perfect dinner, the program was quite complete.

In the baseball game the superb pitching of Fred Schneider carried the Stulzites to victory over the Beachite nine with a score of 4 to 2. Not an inning passed without some diverting byplay. Several times Hales, of the Stulzites, was reprimanded for hesitating at crucial moments, as when the ball was approaching his mit. By skillfully fanning out when bases were full, Parker, the star pinch hitter, came in for no small praise—from the other team. Not quite so skillful, according to close observers, was the batting of "Freddie" Bonnett and the catching of Harry Lange, who stopped many a swift ball, but not always in professional style. Larg's good fielding kept the ball off the ground and won the applause of the Stulzite rooters; nor was Winant's first-base work unrewarded—his long reach missed nothing.

A number of members and guests filed in after the game to attend the dinner. Conspicuous among these were some of the old-timers, such as Hamilton, English and old Reggie Fitzgibbon, who were given a hearty welcome.

The association is looking forward to its annual dinner and the committee is working hard to make it equal to the outing as a memorable affair.

According to a cable from Paris, France's large dyestuff firm, Etablissements Kuhlmann, plans to manufacture artificial wool at Lille in conjunction with the Roubaix textile plants.

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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Harry W. Ormand, Secretary, Union Bleachery, Greenville, S. C.

ANNUAL MEETING OF SOUTHERN SECTION

The annual meeting of the Southern Section of the American Association of Textile Chemists and Colorists will be held at the Cleveland Hotel, in Spartanburg, S. C., on Saturday evening, October 16, 1926.

J. M. Hatch, secretary of the Belmont Processing Company, Belmont, N. C., will address the meeting on "Developments in Mercerization"; Mr. Hatch is connected with the South's newest mercerizing plant, and will have a message of especial interest for the weaver and knitter.

J. E. Dean, superintendent of the finishing plant of the Pacific Mills, Lyman, S. C., will present a paper on "Discharge Printing," a subject of interest to textile chemists, which Mr. Dean is especially qualified to handle on account of his long experience in this class of work.

John A. Law, of Spartanburg, S. C., a leader in the textile industry in the South, will explain the purpose of the textile institute, which is arousing much discussion and high hopes in the cotton textile industry.

Applicants for Membership

Active Membership

Doux, Jules G., salesman, E. I. du Pont de Nemours & Co., New York City. Sponsors: L. J. Roos and and O. T. Poetzsch.

Hauschild, O. Emil, overseer of dyeing, Wm. Skinner & Sons Silk Mills, Holyoke, Mass. Sponsors: D. H. Searle and Braman Proctor.

Kapp, Benjamin, consulting color chemist, Weshine Manufacturing Company, Bronx, N. Y. Sponsors: Chas. C. Knights and H. Herrmann.

Laycock, Joseph G., dyer and finisher, Lowell Bleachery South Plant No. 2, Griffin, Ga. Sponsors: Carl D. Brandt and R. E. Derby.

Paxton, Chas. F., salesman and demonstrator, Innes Speiden Company, Charlotte, N. C. Sponsors: J. Hartley and J. L. Dabbs.

Changes of Address

Alston, John, Dutchess Bleachery, Inc., Wappinger's Falls, N. Y.

Alter, Frederick A., 24 Barney Street, Pawtucket, R. I.

Bashlow, H. I., 4715 Fourth Avenue, care of W. V. Miller, Brooklyn, N. Y.

Bloxham, Chas. W., 69 Finch Street, Pawtucket, R. I.

Dalton, John N., 55 Jackson Street, Lawrence, Mass.

Davis, Mark L., 77 Friend Street, Adams, Mass.

Hayes, Clifford B., care of Lawrence & Co., 24 Thomas Street, New York City.

Morrill, Elliot, 1739 Chase Avenue, Chicago, Ill.

Oates, John F., P. O. Box 432, Roanoke Rapids, N. C.

Pierce, Alvah H., care of General Dyestuff Corporation, 159 High Street, Boston, Mass.

Shea, David J., Jr., 1057 Sheridan B, Apt. 5, Bronx, New York City.

Sturtevant, Harold B., 218 Summer Street, New Bedford, Mass.

Toepler, Carl, Box 35, Fairview, Bergen County, N. J.

Sixth Annual Meeting

American Association of Textile Chemists and Colorists

Friday and Saturday, December 3rd and 4th

Charlotte, N. C.

The First Annual Meeting South

CONSIDER this now and plan definitely to go. Good railroad and hotel arrangements are dependent on an early advice from *you* as to your definite intention to go. We expect to have special sleepers from Boston, Providence, New York and Philadelphia. This again depends on *you*.

Hotels

Rates are from $1.50 to $5.00 for one person and from $5.00 to $8.00 for two persons depending upon the hotel. There are four to choose from, Hotel Charlotte being the headquarters for the meeting.

Railroad Fares

We will get special rates from the railroad company. The larger the party going the better will be the rate, therefore, we can only give you definite advice as to amount after we know how many will go.

Official Meetings of the Association

These will consist of an open forum on Friday evening and all-day sessions on Saturday.

Side Trips

The committee of arrangements in the South has tentative plans for a number of plant visits or other interesting occupations for one or two days prior to the meeting. These plans are dependent entirely upon what **you** want so that any who would like to make some of these side trips should indicate it at the earliest moment.

Returning

The railroad company will have the same sleepers available for our return.

Please do not postpone your decisions but indicate to the committee now your intention of being one of the party.

———COMMITTEE———

Elvin H. Killheffer (Chairman), Newport Chemical Works, Passaic, N. J.
John F. Bannan.....M. T. Stevens & Sons Co., North Andover, Mass.
Ralph F. Culver.....Ciba Co., Peck Street, Providence, R. I.
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Influence of Degree of Dispersion of Dye in Dye Liquors

Wetting Preparations—Factors Bearing on Dispersion—Testing Wetting Capacity of Dye Liquor—Tests with Nitro Silk—Tests with Vat Colors—Influence of Solubility

By DR. R. ROESTEL

(*Melliand's Textilberichte*, 1926, *pages* 228-230)

(Translated by Ismar Ginsberg, B.Sc., Chem. Eng.)

THE color bath is understood to be a solution or suspension of the dyestuff in water, to which other materials are frequently added. The fact that not every solution or every suspension is suitable for dyeing purposes is well known to every practical dyer. Hence, there are certain conditions which must be fulfilled in order that the dye liquor be suitable for the intended purpose. Aside from the correct choice of the dyestuff, the concentration and the temperature of the dye liquor, the manner and means wherewith it is kept in motion toward the substratum which is to be dyed, and other individual factors, certain other conditions are important in this connection. Close observation of these has led to remarkable results.

It is known that the most important condition is the dissolving power of the liquor toward the dye, and this has a very great influence on the state of the coloring matter solution, and hence on the dyeing results themselves. However, inasmuch as dyeing can take place only when the coloring matter is absorbed by the fiber in an irreversible manner, in such a manner that the color cannot be removed from the fiber by simple washing, then it appears clear that the relations between the dyestuff solution and the fiber play an important role in the dyeing process. In other words, it does not follow that because a dye will dissolve in water to form a solution that this solution will give good dyeing results each and every time it is used and whatever fiber it is used on.

Wetting Preparations

The discussion which follows is primarily concerned with the characteristics of the dye liquors; it must also be mentioned that the condition of the fiber at the moment that it comes in contact with the dyestuff also plays an important role in the dyeing process. This is, of course, nothing new. Freiberger (see Melliand's Textilberichte, 1921, page 84) has called attention to the importance of a thorough and as uniform as possible wetting down of the fiber gel before it is brought into contact with the color solution. After the introduction of the wetting and dye-dissolving preparation known as tetracarnite, a flood of new wetting and dissolving media for fats were put upon the market. All of these possessed the power of making the fabric easier to dye; without, however, having a solvent or any other favorable effect on the coloring matter in the dye liquor. Notwithstanding this fact, it remains true that the fibers must be well wetted down before they are further treated with liquid media. A uniformly and well-wetted structure of fibers has an increased cross-sectional area in all directions as compared with the unwetted fibers. A picture of irregular wetting may be gained by comparing this condition with a film of gelatine which is sprinkled in various places with water. The gelatine film will swell up in an irregular manner and will become uneven on its surface. It is understandable that a dyestuff can more easily penetrate between the micellae of a correctly wetted fabric, one that has been thoroughly soaked with the wetting medium, than into a fabric which has not been treated in this manner.

According to Haller, the solution of coloring matter contains particles of different magnitude, some of which are visible under the microscope and some of which are amicroscopic. Hence, less dispersive distribution of the dye in the color liquor is required for cotton than for wool, and it is also known that the acetate silk fibers require a still more finely dispersed coloring matter.

Furthermore, the degree of purity of the textile fiber also plays an important role in this connection, for the impurities of the fiber not only act against the penetration of the dyestuff into the pores of the fiber and resist the wetting action of water, but, inasmuch as they reduce the intercellular surface of the fiber, it becomes necessary to use a very highly dispersed or molecularly dispersed wetting medium for treating the fibers that are in closest proximity to the impurities.

According to the studies that have been made by Pelet-Jolivet on this subject, the electrical charges on the bath and the fibers can be corrected in some suitable manner; for example, by the addition of all sorts of assistants. The addition of these substances changes the surface tension of the liquid, and for this reason or for others the degree of dispersion of the color is altered. Such substances are protective colloids, sulphite cellulose waste liquors, salts of arylnaphthol sulphonic acids, and the like. Complex com-

pounds may be formed which result in an enlargement of the molecule.

Factors Bearing on Dispersion

As the temperature rises, so does the degree of dispersion of the color, and the shades are darker. The fibers absorb more of the dyestuff, for the osmotic pressure and the diffusibility are favorably influenced. A change is also induced in the capacity of the dye liquor to filter through the fibers; which, for example, may hold back hydrogenized soap particles or hydrocarbons. On the other hand, the molecularly dispersed tetracarnite is not adsorbed by the fibers and penetrates through them without any difficulty.

These facts have been brought out in order to show the dependence of the dyeing operation on all sorts of factors which bear a very definite relationship to the degree of dispersion of the color liquor. It is, however, not the author's intention to delve deeper into this matter, for it would lead us too far afield. It appears to be much more advisable to discuss certain investigations that have been made on the solvent properties of color liquors toward dyestuffs. This is a very important matter in practical dyeing.

In the very first operation—the wetting down of the dyestuff with water, which precedes the actual solution process—the suitability or indifference of the wetting fluid is at once evident. Most dyes agglomerate to form balls when wetted with water, and thereafter resist the action of the solvent. It is very hard to obtain a thorough solution of such masses. This is particularly true of the water-insoluble vat and sulphur colors. For this reason it is more advisable to wet the dyestuffs with acetic acid, alcohol, Turkey Red oil or with tetracarnite, which shows the strongest dye-dissolving and wetting properties of all. Then the color is made up into the vat liquor.

It is for this reason that tetracarnite was selected for making the following experiments. The wetting capacity of substances toward dyestuffs was measured in such a manner that equal quantities of color were strewn on the surface of water, tetracarnite or on an aqueous solution of tetracarnite, and the time that it took for the powder to sink was observed. Many dyestuffs which are not wetted by water can be wetted within a few seconds by tetracarnite. This refers to such insoluble substances as the vat and sulphur colors, as well as to some water-soluble dyestuffs which, though wet by water, sink only after a period of several hours. A similar relation exists between the color liquor and the coloring matter on the fibers. When the color liquor is similarly repelled by the dye on the fiber, as well as by an impurity in the fiber—as, for example, the fatty and oily ingredients—then the dyeing cannot be carried to a successful conclusion. The results are irregular. On the other hand, when the color liquor wets the dyestuff in the fibers then there is no reason at all why the dyeing results should not be perfectly satisfactory.

Testing Wetting Capacity of Dye Liquor

The next experiments were concerned with the wetting capacity of color liquors, which were made with the addition of tetracarnite, for a highly colloidal dyestuff. Five pieces of cotton material were dyed with Benzopurpurine 10B after being simply wetted with water for twenty minutes at a temperature of 50 deg. Cent. with fifteen times the weight of water, without the bath or the fabric being moved. The results are given in the following table:

	Per Cent Benzopurpurine 10B	Per Cent Glauber Salt*	C.C. Tetracarnite†
Test No. 1	2	..	..
Test No. 2	2	8	..
Test No. 3	2	..	..
Test No. 4	2	8	0.6 x
Test No. 5	2	8	0.6 xx

(The designation x means the addition of Glauber salt first, and then tetracarnite; while that of xx means tetracarnite first, and then Glauber salt.)

The results obtained were as follows: Sample No. 1 was bright and spotty; Sample No. 2, dark and spotty; Sample No. 3, moderately dark and uniform; Sample No. 4, dark and spotty, and Sample No. 5, dark and uniformly dyed. The perfectly clean cotton material was then dyed in a liquor containing Glauber salt, the bath being vigorously agitated as is customary in practice. It is only this case that the cotton materials were uniformly dyed, while when the tetracarnite was added without agitation and also when the tetracarnite was added first and thereafter Glauber salt, the cotton was dyed in dark shades. The experiment shows that the material was uniformly wetted with tetracarnite liquor and the dyestuff was converted into an optimum condition for dyeing. Glauber salt was then able to exert a better fixing action on the coloring matter.

The same cotton material was then cut into strips and subjected to dyeing for seventy-five minutes with a 9 per cent solution of Benzopurpurine 10B, which means with an excess of the dye, the cloth being agitated while being dyed. The first portion of chemical added to the liquor was introduced at the same time as the dye, the second portion fifty-five minutes later. The previously wetted material was introduced into the liquor at a temperature of 60 degrees, the liquor being then heated to 80 deg. Cent. and thereafter to 92 deg. Cent., when the second portion of the chemical was added. The following tabulation shows the manner in which the liquor was composed in the various tests:

*In grams per liter. †Per liter of liquor.

	Per Cent Benzopurpurine 10B	Per Cent Glauber Salt	C.C. Tetracarnite*
Test No. 1.....	9	..	..
Test No. 2.....	9	20	..
Test No. 3.....	9	..	0.6
Test No. 4.....	9	20	0.6 x
Test No. 5.....	9	20	0.6 xx

*Per liter.

(The liquor in all cases was made up to the same volume by the addition of the correct amount of water; x means first Glauber salt and then tetracarnite and xx means first tetracarnite and then Glauber salt.)

The results of the dyeing process, in which different concentrated dye liquors were used showed that the darkest was number 4; then came numbers 5, 2, 1 and 3 in direct order. It is therefore clear that Glauber salt with tetracarnite gave the best results. Glauber salt alone gave lighter shades, and the dye liquor which contained neither substance gave a still lighter shade. It is also true that when tetracarnite is used alone, the depth of the shade is not satisfactory. Glauber salt has a salting-out action on the color, while tetracarnite has a solvent action. Consequently, there results a certain condition which is optimum for dyeing and in which the tetracarnite exerts an important influence in the presence of the peptizing Glauber salt. The improved dyeing qualities of the liquor which contains both substances is due to the degree of dispersion of the dyestuff.

Test No. 3 was repeated without the use of tetracarnite, it being replaced by several well-known wetting agents and in all cases it was found that lighter shades were obtained.

Tests with Nitro Silk

A number of tests were then made with nitro silk, various basic colors being used in admixture with tetracarnite. The dyestuffs were Chrysoidine G Extra, Rhodulin Heliotrope, Methylene Blue RR. After dyeing, the cloth was slightly soured and washed. The dyeing is effected in this case not with the dyestuff with the addition of tetracarnite, but with the color bases, which were nevertheless in an extremely fine state of dispersion. The dyeings were better than when tetracarnite was not employed.

Wool is a fiber that requires the very highest degree of dispersion of the dyestuff. Woolen fabrics were dyed with Brilliant Green Crystals A Extra, a basic coloring matter, the bath being made in one instance with 1.5 c.c. of acetic acid per liter, and in the second case with 2 c.c. of tetracarnite per liter. The precipitated color base gave a much deeper and brighter shade with the same degree of color penetration and the same fastness to rubbing. This test showed the advantage of high dispersion of the dye.

Tests with Alizarine Paste

Tests were also made to determine the manner in which an alizarine paste would behave as its dispersoid aggregate status in the bath was increased, if the alizarine is rendered more soluble by the addition of alkali. An alumina mordant was used with New Red with 10 per cent of a 20 per cent alizarine based on the weight of the cloth, the water used having a hardness of 10 degrees. The dyeing experiments were made, first, without any addition; second, with the addition of 1.2 grams of a 50 per cent Turkey Red oil per liter; third, with the addition of 0.3 gram of tetracarnite per liter; fourth, with the addition of the same amount of tetracarnite and the other substances used in the second case; fifth, with 0.1 c.c. of ammonia per liter, and sixth, with the same additions as in the second case, but with the Turkey Red oil neutralized with ammonia and in addition with 0.1 c.c. of ammonia per liter.

The results were as follows: The addition of tetracarnite gave the deeper red and the liquor was more quickly exhausted at about 3 deg. Cent. than when this substance was absent. The addition of ammonia also caused a more rapid exhaustion of the color liquor, but the red was duller. The same results were remarked in the liquor containing Turkey Red oil, only that thy were much more marked. The increase in the dispersion of the alizarine, which otherwise takes place at increased temperatures, was effected by these additions. An improvement in the red shade was also obtained, with a saving in the amount of alumina mordant employed, and with exhaustion of the liquor at lower temperatures than usual. Ammonia has a less favorable effect than tetracarnite, for the solution of the dyestuff, when ammonia is employed, appears to take place too rapidly. The added Turkey Red oil in both cases, that is, with the addition of ammonia as well as of tetracarnite, is productive of a more highly dispersed solution.

The next test was made with a color liquor that had been allowed to remain standing for several weeks before being used. This liquor had almost become thick and useless. It was found that even after the addition of new coloring matter the liquor gradually became less and less effective. This liquor is generally allowed to run to waste in spite of the fact that it contains large proportions of color. The dye in the liquor was Naphthol Black. The residue obtained with moderate evaporation gave a deep colored extract with tetracarnite and contained a large proportion of the dye. When 1 c.c. of tetracarnite was added per liter of dyestuff, the liquor was again brought back to a usable condition. On filtration through a thin clay filter a light colored filtrate resulted before tetracarnite was added. After it was added the filtrate was deeply colored. It is evident that in such color liquors there is always a considerable loss of dye, for the latter apparently polymeries or dehydrates, and then does not dye any longer. Or it peptizes due to the increase in the

size of the particles of the dye and hence becomes converted into a state which is unsuitable for dyeing. On the addition of tetracarnite to the color liquor this phenomenon and the losses that result from it are avoided, due to the equalization of the size of the particles in the most favorable dispersive form.

Tests with Vat Colors

These experiments were also extended to cover the vat dyes. Several of the Indanthrene Blue and Hydro Blue marks were used for this purpose. The addition of half a cubic centimeter per liter of tetracarnite cleared up the vat, which became very lustrous in appearance in contradistinction to the vat which did not contain this substance and which was dull in appearance. When an excess of salt or sodium hydroxide liquor is added, then the tetracarnite is precipitated on the surface of the liquor in the form of darkly colored drops, which leave a residue of color on being evaporated. This dye was dissolved by the tetracarnite. The effect of the latter substance was accordingly to increase the dispersion of the dyestuff in the bath. The bath treated with tetracarnite yielded lighter and more uniform colors on textiles and on paper than the liquor which did not contain this assistant. Loose cotton was also dyed in liquors which did and did not contain the tetracarnite, the dyeing being carried out without circulation of the liquor. The addition of the tetracarnite improved the dyeing of the material. This type of dyestuff, which is characterized by the large dimensions of its molecule and the large grouping of molecules, was able under these conditions only to penetrate between the micellae in the cotton fibers, and moreover only when the pores of the fibers had been first widened due to the swelling action and the material had been first properly cleaned. The action is directly traceable to the increased dispersion of the color in the vat liquor.

The same results were obtained when tetracarnite was salted out from liquors that contained sulphur dyestuffs, as, for example, Thiogen Blue M.

Another test was made with an indulin sulphonic acid which was difficultly soluble in water, namely, Fast Blue M, and the same cotton cloth was employed for this purpose as employed above. The cloth was allowed to soak in a water bath, without being worked around in the liquor, at a moderate temperature for a period of two hours. Thereafter the cloth was washed, and two tests were made. One liquor contained 195 parts of distilled water and 2.5 parts of a solution of Glauber salt. The second liquor contained 185 parts of distilled water, 5 parts of tetracarnite, 10 parts of half normal sulphuric acid and 2.5 parts of a solution of Glauber salt. The Glauber salt solution was made from 40 grams of sulphuric acid and 100 grams of sodium sulphate per liter of water. In each case 2.6 grams of the cotton cloth was wetted with the liquor for a period of five minutes in the cold, and then there was added to the liquor in both instances 5 parts of Fast Blue. The proportion of tetracarnite in the liquor was 2.7 c.c. per liter.

It was found that the dyed cloth in the second case was a purer and deeper blue color than in the first case. The cloth was thoroughly dyed and was fast to rubbing. The sulphonic acid is converted into the soluble condition by the alkaline tetracarnite.

Influence of Solubility

Another indication of the influence of the solubility of the color liquors toward dyestuffs was obtained in the reverse manner as that of dyeing. In other words, what was tested was the action of liquor, mixed with tetracarnite and also without this substance, in removing the dye from the fiber. It has been known for a long time that many colors, when dyed on the fiber, are acted upon in different manners by various chemicals. This gives some idea of the character of the bond that exists between the dye and the fiber. Thus, when powerful solvents are employed the dyeing process can be reversed. The following results were obtained with tetracarnite. The difficultly soluble cotton dyestuff Benzo Fast Red L is not removed from the fiber by means of a dilute solution of soda (10 to 1), tetracarnite (3 to 1), Turkey Red oil (5 to 1), plus additional soda (5 to 1), even when the solution is used at the boiling point. On the other hand, Columbia Blue 3G is quite completely removed by this solvent. Then, again, wool dyed with Benzo Fast Red L or with Patent Blue is quite thoroughly decolorized by treatment with tetracarnite (1 to 1); more so than with soda or with Glauber salt solution acidified with sulphuric acid. This substantiates the fact that the affinity of the color for the fiber can be overcome under certain conditions. It is possible, by using the correct amounts of various solvents, to slow up the dyeing process and in this way to obtain more uniformly dyed fabrics.

These experiments substantiate the assumption, made by Haller, that the color in the dye liquor is present in a polydispersive condition; that is, in larger particles and in the amicroscopic form. Furthermore, it has also been confirmed that, particularly when the dye liquor is allowed to remain for some length of time, and even in the ordinary dyeing process, those particles of the dyestuff which are too large for the fiber being dyed are either held by the fiber in a loose condition or else cannot penetrate deeply enough between the micellae, in order to produce fast dyeings. Furthermore, it is also evident that these large particles may stuff up the pores of the fibers and thus hinder the particles that are of proper dimensions from penetrating into the fibers and dyeing them properly. The result is a fabric which is irregularly dyed. When the dyestuff is not properly dispersed in the dye liquor, it is lost as far as the dyeing process is concerned. Perhaps the first observation made along these lines

was in the case of the Indigo vat, and the losses that occurred from the residual Indigo in the vat slimes. However, it is possible to reduce such losses to a considerable degree by the proper treatment.

So far as the dyeing of the inner surfaces of the fibers is concerned, not only is the optimum condition of the dyestuff determinative, but also the wet-penetrating and filtering capacities of the color liquor are important. In this case, however, such wetting agents which stick to the fiber, or which dye it or which increase the molecule of the dyestuff, are not suitable. Such substances as result in the formation of dyestuff complexes or which lower its degree of dispersion in the dye liquor are also detrimental. What are desired are assistants which pass through easily the outer and inner surfaces of the fibers and improve the dyeing process either by increasing the degree of dispersion of the color, and thus bring it into the optimum condition for being absorbed by the fibers. Thus the dye liquor is assisted over difficulties and the assistant removes the impediments to the proper penetration of the dye; as, for example, by emulsifying the fats present in the fibers.

Conclusion

It has been demonstrated in the first place that in order to obtain good results in dyeing it is necessary to use a color liquor in which the dye is in the optimum dispersed condition. This also aids in the economic utilization of the dyestuff.

The tests described in the foregoing experiments deal with the use of the direct, vat, sulphur, alizarine, acid and basic colors, and also of color bases which are either difficultly or totally insoluble in water.

The tests have dealt with the suitability of these colors for vegetable and animal fibers, as well as for artificial silks, for materials that are easily or difficultly penetratable by these solutions.

The addition of a proper solvent to the color liquor, the character of which solvent depends on the dyestuff used, can give the liquor this desirable property.

The wetting of the material being dyed improves the dyeing.

The substance used in admixture with the color liquor must also be a wetting medium for the fiber, and the latter must be as free as possible from fatty impurities as well as others. This substance also must not prevent the dye from attaining the proper dispersive condition, and must not dye the fiber and not stuff up its pores. The tests which have been carried out with tetracarnite indicate that it is a substance which fulfills these requirements.

Practical Hints on the Production of Bright Colors on Textile Fabrics

Part XXVI

Multicolor Spray Effects—Construction of the Plant—Its Operation and Special Features

(Continued from page 546)

By RAFFAELE SANSONE

WITH certain classes of goods it may be necessary to produce over the front or back of the cloth two or three color superficial spray effects to obtain special characteristics not possessed by many other articles. In this instance a process is required which effects the even distribution of each color so that it goes on clearly on the finished material without penetrating too deeply or passing through to the back, which can thus remain untreated or can be differently colored, as may be required.

Formerly a similar treatment of the material would have been effected with volatile solvents on large wooden tables, where the sprayed portions are allowed to evaporate of their own accord, contaminating the air of the dyehouse and affecting the operatives. At present, however, plants can be constructed where the volatile solvents are not only absorbed before causing injury to the operatives, but also recovered for the greater part. Besides this, through the adoption of different methods it is possible to substitute the volatile solvents in many cases with water.

A plant where both the above advantages can be secured, considerably lessening the cost of production of the cotton goods, is constructed on the principle shown in Fig. 1.

Here is to be seen a light iron table (T), of convenient height to permit an easy access from all parts. The first half is made of a thick copper-plated iron plate. Its supporting legs (L) have bushes for carrying the end shafts of a beam of cotton cloth (Mo) and a special spreading and opening arrangement V for pressing.

Just above the first half of table T are fitted, by a light iron stand, five series of color-distributing troughs (A, B, C, D, E), constructed of glass or other adequate material. Covers (c, c, c, c, c) descend on the

upper portion of the troughs for about 1 inch, closing the same hermetically. The top of the covers is supplied with small taps (t, t, t, t, t), regulating the entrance of the air necessary to allow, in each case, the descent of the different dye liquors.

The second half of table T, indicated in the figure by U, is entirely of copper or brass, and hollow inside. It is perforated at regular intervals and enclosed in a rectangular case K, having double walls, between which hot air, prepared in a small apparatus at the back of the plant, is made to circulate.

The top of this case contains an opening for the entrance of the sprayed cloth, while at the bottom is a second opening through which the material passes out after being dried by passing several times backward and forward on small copper guide rollers. Case K also has a large door on one side, allowing easy access to the interior. The portion of table T enclosed in case K has a large tube (Y) leading downward to a long copper outlet S contained in a rectangular cham-

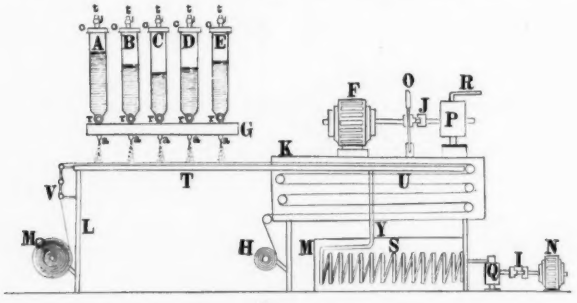

FIG. 1

ber (M), cooled with running water entering through a tap at the top and passing out at a great speed by an opening at the bottom. In serpentine S all gases and vapors are condensed to liquid form and can be withdrawn in a small collection cistern. Pump Q is driven in this case by a small electric motor (N), the action of which can be initiated or stopped through friction clutch I.

Above case K is placed a second pump P, worked by electric motor F, which can be started or stopped by simply moving hand lever O, which works friction clutch J. On the upper part of pump P is placed tube R leading to the outside. Pumps P and Q are of the ordinary centrifugal type, and their end shafts run in ball bearings.

The bottoms of the series of troughs (A, B, C, D, E) have a special distribution arrangement (r, r, r, r, r), the working principle of which is indicated later, and the sprayers a, a, a, a, a, all of which are fixed in the sustaining block G.

The guide rollers in the interior of oven K have at each extremity a groove serving for the strings entering the cloth to be sprayed and dried in full width. Two similar grooves are also present on the guiding-out roller just above the winding-on beam H.

The movement of the cotton pieces is conducted by a special mechanism, worked by a large electric motor, not seen in the figure. This can be made to move the material forward continuously, or for an interval that can be regulated at will in seconds by a special arrangement, to stop the mechanism for a fixed period of time, and then move it forward again. All such movements can also be done at several speeds, and work in conjunction with another movement regulating the working of the distribution arrangements r, r, r, r, r, and indicated in its most elementary principles in Fig. 2.

This shows a side view of one of the troughs for the dye liquors, surmounted by cover C and with tap 2, having at the bottom a broad tank ending in a cylindrical shell R, in which is placed a semi-cone S, turned at the maximum speed by pinion wheels X U, at a medium speed by pinions Y V, and at the slowest speed by pinions J T. In this instance the upper pinions X, Y and J are moved by the small electric motor M, when lever L is displaced.. The lower portion (G) of this lever is fixed in a lower bush, and moves friction clutch F. The position of the pinion wheels below the upper pinions X, Y, J is regulated by a shell (K) which sustains them, and that can be fixed on a steel shaft (O) in any required position through the spring arrangement E.

Electric motor M is placed higher than semi-cone S on cube Q. The whole mechanism is fixed on block B, which also contains sprayer I. The mechanism driving the plant (see Fig. 1) is connected with electric motor M, and the action of this can be suspended whenever it is wished to pass the material through the plant without coloring, as may be required when two joined borders are reached, when it is wished to leave untreated a waste cotton piece used for the preliminary coloring trials, etc. It is, however, always suspended after completing each lot of spraying colors.

OPERATION OF THE PLANT

Operation of this plant requires some practice and experimentation before it can be conducted to the best advantage. When using water solutions of the coloring matters and producing five consecutive single-colored stripes across the weft of the material, repeating these over and over again without leaving uncolored portions in between, a single color is placed in each series of troughs (A, B, C, D, E) that have been carefully cleaned.

When the above has been conducted, covers c, c, c, c, c are placed on the troughs for closing them hermetically and taps t, t, t t, t are opened in full. A strip of two or more yards of clean waste cotton cloth is now sewn to the beginning of the pieces of cloth to be treated, which have been entered on a wooden beam placed in the supports on L. The beginning of the

waste cotton cloth is passed through arrangement V, pulling it by hand over table T so as to go beyond block G (see Fig. 1) an inch or two.

After this has been accomplished, two strings are tied to the extremities of the cloth, and by opening the door on one side of oven K these are caused to enter in the grooves at the extremities of the guide rollers and of the outer guide roller which leads to the winding-on beam H.

The speed to be given to the semi-cones in the distribution arrangements r, r, r, r, r is then regulated and the mechanism driving the plant is started, after arranging the stop period and the interval for each forward movement. This carries forward at a regulated interval the waste piece of cotton cloth, stopping it after this and causing the five series of distributing arrangements and sprayers to form between them five strips across the material.

The plant, after this, stops automatically all further passage of color bath and carries forward the piece. At this point the plant is stopped for the purpose of observing if the desired intensity of color has been produced, and if the penetration of this is sufficient or too strong. Should the penetration be too strong, taps t, t, t, t, t are tightened and the trial repeated on a second portion of the waste piece.

Once the spraying intensity has been arranged as above, the plant is allowed to continue work of its own accord, the delivery of further spraying liquor is delayed until the beginning of the first piece to be treated approaches, when the plant is allowed to run fully.

In this way the material receives a first lot of stripes, followed by a second lot immediately at a short distance from the first. In the meanwhile, between the double walls of oven K is made to circulate the hot air prepared in the small apparatus at the back of the plant, which soon brings the air in the interior to a degree above 100 deg. Cent. Pumps P and Q are then started.

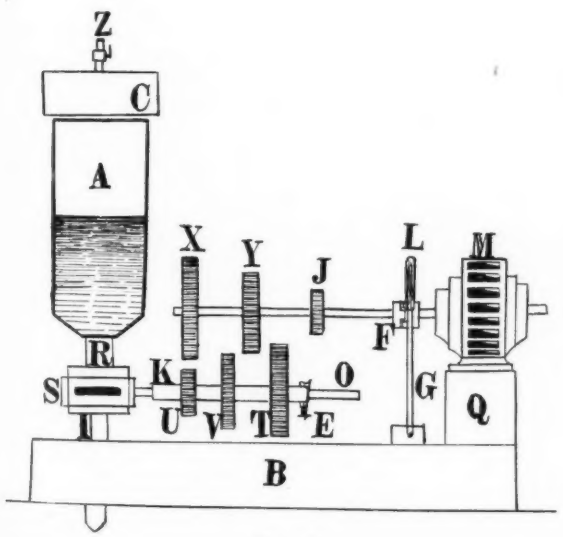

FIG. 2

As the sprayed material makes its way in oven K it comes in contact with heated rarefied air, while a certain drying takes lace through its body passing a good portion of the vapors developed through the perforations in the portion of table T indicated by U. At the same time, pump P removes the vapors still remaining in chamber K. In this way all water it contains is evaporated, bringing about a rapid fixation of the color in the different stripes by the time the sprayed fabric leaves the plant. If it is necessary to follow the first beam of material before L by a second, the usual joining operations are effected while the plant is stopped, the first lot of colored material being detached as it makes its way on the winding-on beam H.

ADVANTAGES OF THE PLANT

The plant possesses the following advantages:

1. The series of sprayers a, a, a, a, a can produce on the cotton fabrics distinct stripes with the same or different colors placed quite close together and composed of several squares immediately one after the other, without blending with one another; stripes formed of squares of different color, the two sides of which blend with neighboring colors, if these are present; stripes produced as above at a certain interval apart, etc.

2. By allowing the machine to run continuously without arranging any stoppages, preparing the cloth beforehand on a stenter in a straight position all through, and only using one of the series of sprayers with different colors of reduced intensity, long stripes can be produced down the warps of the cotton cloth goods.

3. By causing the machine to run with regulated intermediate stoppages, and maintaining the conditions just indicated, stripes can be produced that are broken at intervals.

4. The distribution of the different color liquids is regulated mechanically and through the amount of air let out, and this allows the production of effects that range from the lightest sprays to the most intense effects.

5. The intensity of the sprays can be different from one stripe to the other, and in the same stripe.

6. The sprayed effects can be produced with volatile solvents by using only serpentine S and pump Q, or with water solutions using both pumps P and Q.

7. The cotton piece goods are colored and dried in one run, preventing all danger of smudging.

8. Through the adoption of the mechanical distribution arrangements, the different coloring liquids pass through the sprayers under a certain pressure.

Abstracts—Division of Water, Sewage and Sanitation

American Chemical Society, Philadelphia, Pa., September, 1926

THE following abstracts of papers delivered before the Division of Water, Sewage and Sanitation of the American Chemical Society, at its meeting in Philadelphia three weeks ago are given here because of their interest to textile chemists, bearing as they do upon the difficult problem of removing trade wastes.

Recent Developments in Zeolite Softening. A. S. Behrman. The demands upon the modern zeolite water softener are considerably more exacting than those made on its predecessors. Chief among these demands are greater softening capacity per given volume of zeolite, more rapid rate of base exchange, and a minimum loss of water pressure through the zeolite bed. A distinct advance in the attainment of these objects has been made possible by the development of the synthetic "gel" type of zeolite, which is the principal subject discussed in this paper. A brief review of previous practice and materials is also given.

Effect of Temperature on Sewage Sludge Digestion. W. Rudolfs. Studies were made on the effect of temperature and reaction on sludge digestion. Digestion is extremely slow at temperatures below 50 deg. Fahr. Raising the temperature a few degrees above 50 has comparatively little effect. Digestion time is materially decreased with higher temperatures. Maximum digestion takes place at about 80 deg. Fahr. Certain quantities of organic material produce about the same volume of gas at all temperatures. Gas production depends upon the reaction of the medium. Temperatures above 85 deg. Fahr. retard gas production. The average numbers of bacteria (on agar plates) in unadjusted sludge do not increase with the increase in temperature. The average numbers (on agar plates) in adjusted sludge decrease with the increase of temperature. Exclusion of air induces liquefaction and increases the rate of solids reduction. This liquefaction can be changed by proper reaction and proper temperature to gasification. With the increased rate of digestion odors are intensified.

Chemical Treatment of Trade Waste—III. Optimum Conditions for the Removal of Color. Foster D. Snell and Cyril S. Kimball. Precipitation tests at known pH values on twelve dyes gave data in which three variables must be considered; effect of lime alone; effect of copperas alone; decolorizing effect of the precipitated hydroxide. The following conclusions are indicated: In coagulation the effect of lime or copperas on the dye is fully as important as the effect of the precipitate; aside from the effect of the reagents alone the expected results are obtained of removal of acid dyes, non-removal of basic dyes, and variable results with direct dyes. Taking all three effects into consideration the maximum decolorization will usually be obtained at about the phenolphthalein end point.

The Effect of Chlorination on Sanitary Chemical Analysis of Water. J. W. Sale and C. H. Badger. When chlorinated samples were subjected to sanitary chemical analysis the results, especially the figures for nitrite, appeared to be incorrect and to warrant further investigation. Synthetic samples were prepared and analyzed with and without the addition of free chlorine. The following conclusions, among others, are drawn as a result of the investigation:

The chlorination of water materially affects the content of free and albuminoid ammonia and nitrite as determined by the methods ordinarily used. The effect is greatest in the case of nitrite. The content of nitrate is not materially changed by the addition of free chlorine.

The extent of the changes produced by chlorination depends upon the quantity of free chlorine added, and upon the degree of pollution of the water, a given quantity of free chlorine having less effect on the content of free and albuminoid ammonia and nitrite as the degree of pollution is increased.

The presence of free and albuminoid ammonia and of nitrite, especially the latter, appears to have greater significance in the case of chlorinated samples than in unchlorinated samples because of the tendency of free chlorine to reduce the content of these constituents, and to exert a preservative action on the samples.

Some Experiences in the Practical Disposal of Trade Waste Produced in the Mercerizing, Bleaching and Dyeing of Cotton Material. W. E. Hadley. Increasing legislation, during the past few years, has brought the manufacturers of New Jersey to the necessity of some form of treatment of their waste liquors before same can be discharged into the rivers and brooks. This paper deals with the brief summary of the laws covering the situation, the type of trade waste encountered, and the means which have been employed during the past few years in satisfactorily treating and disposing of the various trade wastes which have come to the writer's attention.

NEW BEDFORD SCHOOL OPENS EVENING CLASSES

Starting with an enrollment of more than 800, the evening classes of the New Bedford Textile School were resumed on September 27. The most popular courses, it was announced, are the machine-shop course, drawing-in class, and plain loom fixing. Registration will continue during this week, until October 8. The day classes, according to recent figures, numbers eighty, with more registrations expected.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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THE GROWING PRESTIGE OF THE CHEMIST

AT its conference in Washington a few weeks ago the International Union of Pure and Applied Chemistry made the following recommendation:

> To engage the public and governments of every civilized country in the right and justice of giving more adequate remuneration to the men of science who by their research, their discoveries and their inventions have rendered eminent service to humanity.

What will be the reaction to this of men engaged in scientific work? To be more specific, since the recommendation is fostered by chemistry, how will the average chemist receive the news that more commensurate reward is being advocated for the higher scientific work which he some day hopes to do?

The chemist who has already won public recognition by his achievements will have but little personal interest in the prospects of larger material rewards. He will naturally give his approval to any project for increasing the economic value of his profession, but if he is the type of man we have in mind he will do so merely to help those on the way up. As for himself, he has undoubtedly learned, as Dr. Blum recently said, that any scientist who receives no satisfaction other than his salary, be it large or small, is poor indeed.

But to the young chemist in industry, in the mill or in the dye laboratory, who nourishes visions of serving humanity by his discoveries, it should be encouraging to feel that the world is being urged now to bestow more adequate appreciation upon those who dedicate their lives to such service.

Even to the chemist who has decided to remain in industrial work, it must be reassuring to watch the gradual but none the less certain growth of his prestige. Chemical societies and associations are helping to raise the status of the profession and to increase public esteem for the chemist by continually emphasizing the importance of a broad, thorough training in the fundamentals, as a basis for intensive specialization. Jealously they protect the integrity of their calling by increasing its requirements, barring those who shirk the drudgery of apprenticeship which must precede all worth-while endeavor.

It is natural that the chemist should feel a sense of growing importance. But this ought not warp his attitude toward his present work. There is danger in harboring the idea that one's daily tasks are trivial. A sense of our own importance should not smother a belief in the importance of our work. Let us grant that the chemist in the mill laboratory or in the dye plant is often regarded by the management as a mere worker, a cog necessary to the smooth operation of the business. But let that worker become dissatisfied by the bitterness of such a notion and his progress ceases. That type of personal discontent is devitalizing to ambition.

No labor, however insignificant, is totally unimportant. The routine testing work alone justifies the place of the laboratory in the mill. Perhaps through a saving made in supplies by detection of an inferior product; perhaps by the solution of a problem that has slowed up the work of the dyehouse; in some manner can the chemist reassure himself of the importance of his work, if only in the thought that his small efforts are indirectly benefiting the unheeding world outside by the perfection of some useful article of commerce. In this way respect for the position of "cog" displaces the discontent arising through unappreciation.

Every man is valuable in his place if he would but work conscientiously; but not always, as in the case of the industrial chemist, does that value steadily increase. Industry is finding that it is eminently worth while to employ competent technical men at any cost, for it realizes that its elaborate manufacturing and sales organizations would come to a standstill without the knowledge of the technician. But the offer of greater remuneration for chemists will not itself raise their status in industry. The reverse is true—the conscientious, well-trained man, upholding the reputation of his craft by the manner in which he dispatches the tasks assigned to him, will help to raise the remuneration.

A NEGLECTED SOURCE OF INFORMATION

THE production manager of the mill, or the dyer or chemist who is not acquainted with the information service made available by various departments of the Government is overlooking an important means of keeping well informed. The trade news, statistics and technical reports issued by some of the Federal bureaus have become a source of valuable information to those who make use of them.

During the past few years the Department of Commerce, under the skillful supervision of Secretary Hoover,

has systematically extended its activities into every branch of commerce and industry. By means of a dependable news service it keeps the business men of the country in touch with the changing winds of commerce which promote or threaten their prosperity. The Bureau of Foreign and Domestic Commerce compiles data on practically every commodity entering or leaving the United States and its territories. By distributing news and statistics to trade papers and trade associations of, for example, the textile and the chemical industries, it enables mills and plants to watch the trend of their trade from week to week, as shown in imports of cotton and wool and foreign dyes or in exports of silk goods and rayon, coal tar crudes and finished colors. If Spain needs looms, if France is buying machinery, if Finland has raised its tariff on printed silk, if Turkey lays an embargo on synthetic Indigo, the news usually reaches us first through the channels of this industrious bureau. From the Tariff Commission we get our annual Census of Dyes and other Coal Tar Products, which gives us an accurate statistical picture of what our dye industry accomplished during the year.

In like manner technologists, chemists, engineers and other professional men keep in contact with the latest projects in technical and scientific research through the publications of the Bureau of Standards. Government master specifications have been established for hundreds of products, from leather belting and canned vegetables to laundry soap and colored wool waste; data on each new specification are given in pamphlet form. Reports and investigations on scientific studies such as the testing of detergents, the shrinkage of shade cloth, the sizing of cotton goods, the fastness of dyes to light and washing, are continually being prepared and issued as publications of the bureau. A hundred such pamphlets can easily be squeezed into the vacant space on the laboratory bookshelf and because of their brevity they are often ideal for quick reference.

Government printed matter is issued with no blatant proclamations such as accompany the publications of private publishers; it is accepted and used by a comparatively few business firms, with little or no comment upon its value and little or no recognition of the work involved. Consequently much that is of practical value does not come to the attention of those who could make the best use of it.

PRODUCTION OF ANILINE IN ITALY

According to the recently published 1924 Annual of the Chemical and Pharmaceutical Industry of Italy, the production of aniline reached a new high figure in 1924, when 1,980,000 pounds were produced.

The Italian exports of aniline are negligible. Large though decreasing quantities are imported from Switzerland and Germany; the 1924 imports were 5,940,000 pounds, as compared to 8,534,000 in 1923.

DINNER TO CHARLES L. GAGNEBIN AND HERBERT W. REED

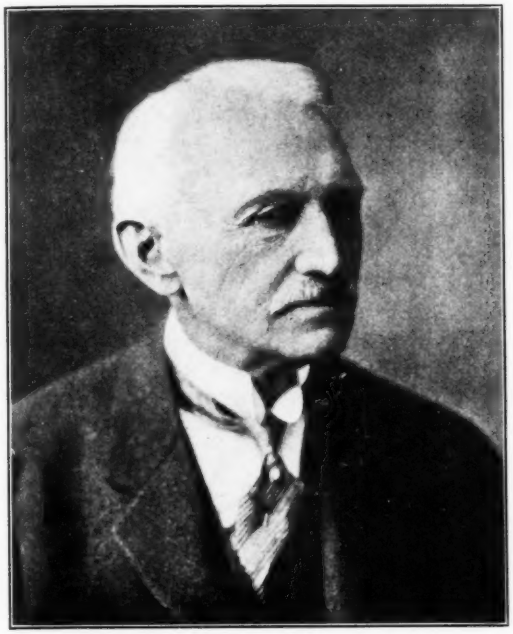
A testimonial dinner was given to Charles L. Gagnebin and Herbert W. Reed by their friends in the dyestuff fraternity at the Algonquin Club, Boston, Monday, September 27.

Messrs. Gagnebin and Reed severed their connection with the General Dyestuff Corporation on October 1, and will retire from active participation in the dyestuff industry. The dinner was tendered them as a formal leavetaking by business friends of many years' standing.

A handsome souvenir program containing excellent portraits of the two guests—reproductions of which appear herewith—was used to commemorate the occasion. Accompanying the portraits was the following personal comment:

> Charles Louis Gagnebin, for forty-four years connected with the dyestuff industry. Born in New York City, he entered the dyestuff business in 1882, with the St. Denis Dyestuff & Chemical Company, and continued with them and their successors in New York and Philadelphia until 1888. In that year he came to Boston as the representative of Schulze-Berge & Koechl, with whom, and their successors, Schulze-Berg, Koechl & Movius, Victor Koeohl & Co., H. A. Metz & Co., Farbwerke Hoechst Company and the General Dyestuff Company, he has since been associated.
>
> Thus, for thirty-eight years Charles Louis Gagnebin has been a foremost figure in the New England dyestuff trade.
>
> Affable, alert, an energetic executive and con-

Charles L. Gagnebin



Herbert W. Reed

siderate counselor, this long period of diligence in the dyestuff trade has endeared him alike to customers and competitors.

* * * *

Herbert Warren Reed, for more than twoscore years connected with the distribution of dyestuffs. Born in Belmont, Mass., he entered the Boston office of Wm. Pickhardt & Kuttroff in September, 1883, this firm being at that time, as they and their successors have been ever since, the American representatives of the great German dyestuff and chemical concern, the Badische Anilin & Soda Fabrik.

For this whole period of more than forty-three years, successively as bookkeeper, salesman and New England manager, Mr. Reed has been identified with the products of this firm and its affiliated companies.

Conscientious, courteous, a faithful factor and earnest emissary, his unswerving honesty and lasting loyalty have gained for him the friendship of his customers and esteem of his competitors.

Following the dinner, which was attended by upward of one hundred guests, Alan A. Claflin was introduced as toastmaster by Arthur Norton. Mr. Claflin eulogized the guests of honor and called first upon Col. Herman A. Metz, who spoke at length regarding his long association with Mr. Gagnebin and paid high tribute to his sterling qualities. Colonel Metz was followed by Ernest Hallbach, who spoke in a similar vein regarding Mr. Reed.

Following these two principal speakers, various members of the assemblage were called upon by the toastmaster, each of whom added words of praise and affection for the guests of the evening. Howard S. Neiman, editor of Textile Colorist, was one of the speakers who seemed to voice the sentiments of the meeting in a peculiarly happy vein.

RECENT LITERATURE

The 1926 Year Book of the National Association of Cotton Manufacturers.

The ninth edition of this Year Book will, like its predecessors be found of great value and interest, not only to cotton manufacturers but to many others interested in the various branches of the textile and allied industries. The volume is divided into three specific parts: The first consisting of statistical matter and comprising approximately one hundred and fifty pages; the second technical material, including many valuable tables and finally a section dealing purely with matters of the association and including lists of officers and members.

The statistical material has all been brought to date and much new material added in order that a complete survey of the cotton industry may be available to assist in the solution of some of the manufacturers' problems.

The technical section is similar to that published last year, with some additional material, which includes tables for cotton count in denier, comparison of English and French counts, conversion of thermometer readings, and a list of the rules governing the transactions between buyers and sellers of silk in the United States.

The Year Book has come to be recognized as one of the leading authoritative sources of information on cotton production and manufacturing, and is in use in practically all of the cotton manufacturing countries of the world.

DYESTUFFS IN CEYLON

The market for dyestuffs in Ceylon is negligible, as there are no dye-consuming industries other than native basket weaving and some fabric weaving. The natives use their own dyes, made from various indigenous plants and flowers. Although a small quantity of package dyes are imported by the larger drug stores in Colombo, the native output of finished products is too small to create a large demand.

In 1924 the imports of aniline colors declined over 50 per cent from the 1923 figure, while the receipts of cutch and "other dyes" increased in nearly the same proportion.

Germany was the source of most of the aniline colors and India of the cutch. Of the "other dyes," the United States shipped 200 pounds in 1923 and increased the amount to 500 pounds in 1924.

The Reduction Products of Azo Dyes

Part XXI

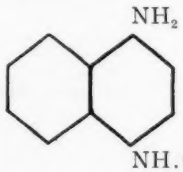
By WALTER C. HOLMES

Color Laboratory, Bureau of Chemistry

[EDITOR'S NOTE.—*The most practical and effective method for the identification of azo dyes consists in the isolation and identification of the products which they yield on reduction. This method finds less application than it might or should, partly because some of these products have never been isolated and investigated, and partly because much of the data which has been obtained in regard to such reduction products is greatly scattered and very difficult to locate.*

Mr. Holmes has made a search for all the available information on such reduction products, and this series contains a digest of his results with a systematic listing of the reduction products of the azo dyes published in the Colour Index, together with the available data on such properties and reactions as would be of service in their identification.]

No. 269.—4-PHENYLAMINO-1-NAPHTHYLAMINE



$C_{16}H_{14}N_2$; Mol. Wt. 234.21; (C, 82.0%; H, 6.0%; N, 12.0%).

Derived from C. I. No. 439.

Glittering leaflets (benzene), mpt. 148°.

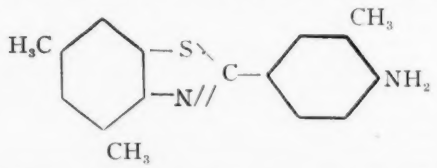
Acetyl deriv.; leaflets, mpt. 192°, readily sol. in alc. but nearly insol. in ligroin.

Oxidized by HgO to 1, 4-naphthoquinonephenyldiimide, yellow-red glittering cryst, mpt. 128-9°, readily sol. in alc., ether or benzene.

On heating with benzaldehyde, it yields 4-phenylbenzalnaphthylenediamine, green-yellow cryst. (abs. alc.), mpt. 109°, readily sol. in ether and benzene.

On boiling with CS_2 and alc. it yields 4-phenylnaphthylenediaminethiourea, sp. sol. cryst., mpt. 196°.

No. 270.—DEHYDROTHIO-m-XYLIDINE



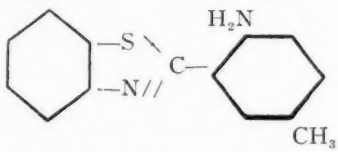
$C_{16}H_{16}N_2S$; Mol. Wt. 268.28; (C, 71.6%; H, 6.0%; N, 10.4%; S, 12.0%).

Derived from C. I. Nos. 127, 129, 130 and 131.

Yellow-white prisms (alc.), mpt. 107°, bpt. 283° at 14 mm. Insol. in H_2O, sp. sol. in cold alc., readily sol. in hot alc. Its salts are decomposed by H_2O. The diazo deriv. is readily sol. On sulfonation it yields a sp. sol. yellow acid of which the salts are colorless.

Acetyl deriv., needles (alc.), mpt. 227°.

No. 271.—ISODEHYDROTHIO-m-XYLIDINE



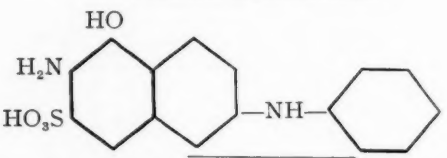
$C_{16}H_{16}N_2S$; Mol. Wt. 268.28; (C, 71.6%; H, 6.0%; N, 10.4%; S, 12.0%).

Derived from C. I. No. 132.

Yellow needles, mpt. 121°. It is insol. in 30% HCl whereas dehydrothio-m-xylidine is sol. in that solvent.

Acetyl deriv., mpt. 201-2°.

No. 272.—2-AMINO-3-SULFO-1-NAPHTHOL-5, 6-PHENOCARBAZOLE

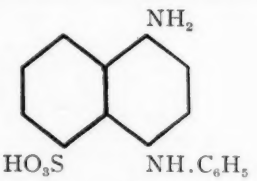


$C_{16}H_{12}N_2O_4S$; Mol. Wt. 328.25; (C, 58.5%; H, 3.7%; N, 8.5%; O, 19.5%; S, 9.8%).

Derived from C. I. No. 65.

No data available.

No. 273.—4-PHENYLAMINO-1-NAPHTHYLAMINE-5-SULFONIC ACID

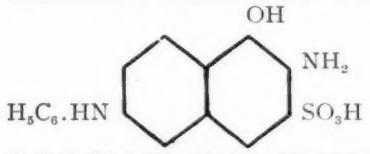


$C_{16}H_{14}N_2O_3S$; Mol. Wt. 314.27; (C, 61.1%; H, 4.5%; N, 8.9%; O, 15.3%; S, 10.2%).

Derived from C. I. Nos. 96, 208, 288 and 307 (Durol Black B and 2B).

No data available.

No. 274.—2-AMINO-6-PHENYLAMINO-1-NAPHTHOL-3-SULFONIC ACID

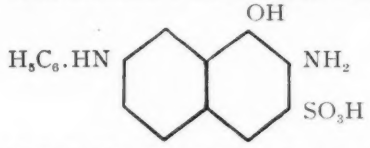


$C_{16}H_{14}N_2O_4S$; Mol. Wt. 330.27; (C, 58.2%; H, 4.3%; N, 8.5%; O, 19.4%; S, 9.7%).

Derived from C. I. Nos. 319, 325 and 353A.

No data available.

No. 275.—2-AMINO-7-PHENYLAMINO-1-NAPHTHOL-3-SULFONIC ACID

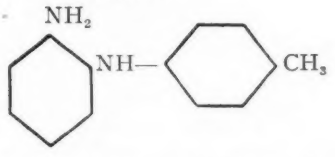


$C_{16}H_{14}N_2O_4S$; Mol. Wt. 330.27; (C, 58.2%; H, 4.3%; N, 8.5%; O, 19.4%; S, 9.7%).

Derived from C. I. Nos. 423, 556 and 629.

No data available.

No. 276.—2-p-TOLYLAMINO-1-NAPHTHYLAMINE



$C_{17}H_{16}N_2$; Mol. Wt. 248.13; (C, 82.2%; H, 6.5%; N, 11.3%).

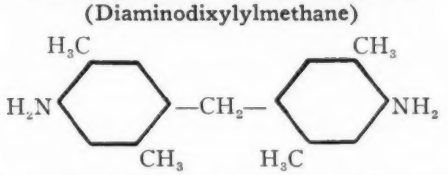
Derived from C. I. No. 279.

Glittering white clustered needles (ligroin), mpt. 146-7°, which turn reddish on long exposure. Readily sol. in most organic solvents. *Hydrochloride*, needles, insol. in HCl.

Oxidized with lead oxide it yields a tolunaphthazine, broad citron-yellow needles (alc.), mpt. 169°, sol. in H_2SO_4 with a dark red color, yellow pptte. on dil. With formaldehyde it yields a product which is sp. sol. in alc., cryst. in white prisms and melts at about 200°.

Coupled with diazobenzene chloride it yields an azo dye, dark red leaflets, mpt. 156°.

No. 277.—4, 4'-DIAMINO-2, 5, 2', 5'-TETRAMETHYLDIPHENYLMETHANE
(Diaminodixylylmethane)



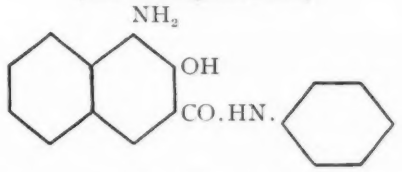
$C_{17}H_{22}N_2$; Mol. Wt. 254.28; (C, 80.3%; H, 8.7%; N, 11.0%).

Derived from C. I. No. 356.

Colorless glittering needles (alc.), mpt. 144° (also reported as 138-9°). Readily sol. in alc. and ether, insol. in H_2O. The aqueous sol. of the hydrochloride is colored deep violet by warming with $FeCl_3$.

Boiled with dil. HCl and nitrite it yields the corresponding dihydroxy deriv., mpt. 181°. The latter substance on bromination yields a di-bromo deriv., mpt. 152°.

No. 278.—1-AMINO-2-HYDROXY-3-NAPHTHOIC-ACID ANILIDE
(Amino-Naphthol AS)

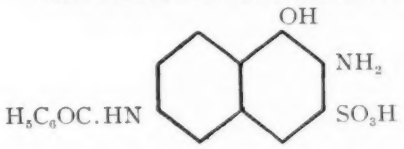


$C_{17}H_{14}N_2O_2$; Mol. Wt. 278.21; (C, 73.4%; H, 5.1%; N, 10.1%; O, 11.5%).

Derived from C. I. Nos. 44, 70, 113, 116 and 117 (see notes) on the fiber.

Apparently no data are available. The free amino acid melts at 205.5° and Naphthol AS, itself, at 240°.

No. 279.—2-AMINO-6-BENZOYLAMINO-1-NAPHTHOL-3-SULFONIC ACID

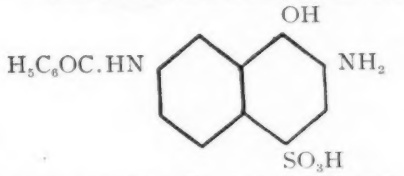


$C_{17}H_{14}N_2O_5S$; Mol. Wt. 358.17; (C, 57.0%; H, 3.9%; N, 7.8%; O, 22.3%; S, 9.0%).

Derived from C. I. No. 278.

No data available.

No. 280.—2-AMINO-7-BENZOYLAMINO-1-NAPHTHOL-4-SULFONIC ACID

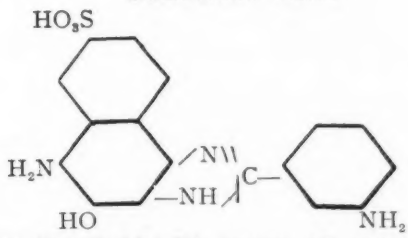


$C_{17}H_{14}N_2O_5S$; Mol. Wt. 358.17; (C, 57.0%; H, 3.9%; N, 7.8%; O, 22.3%; S, 9.0%).

Derived from C. I. No. 444.

No data available.

No. 281.—m-AMINOPHENYL-1, 2-NAPHTHIMINAZOLE-4-AMINO-3-HYDROXY-6-SULFONIC ACID

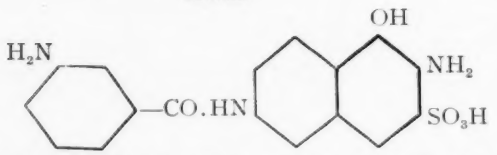


$C_{17}H_{14}N_4O_4S$; Mol. Wt. 370.29; (C, 55.1%; H, 3.8%; N, 15.1%; O, 17.3%; S, 8.7%).

Derived from C. I. No. 323.

No data available.

No. 282.—6-m-AMINOBENZOYLAMINO-2-AMINO-1-NAPHTHOL-3-SULFONIC ACID

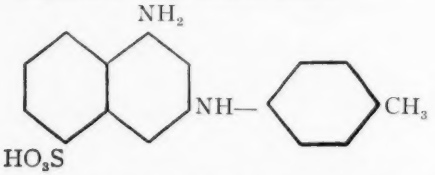


$C_{17}H_{15}N_3O_5S$; Mol. Wt. 373.29; (C, 54.7%; H, 4.1%; N, 11.3%; O, 21.4%; S, 8.6%).

Derived from C. I. No. 324A.

No data available.

No. 283.—4-p-TOLYAMINO-1-NAPHTHYL-AMINE-5-SULFONIC ACID

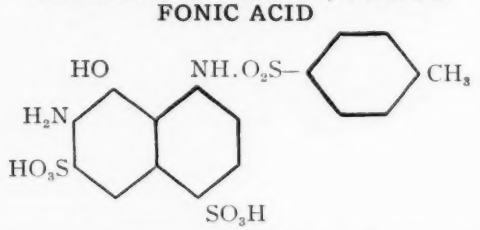


$C_{17}H_{16}N_2O_3S$; Mol. Wt. 328.29; (C, 62.2%; H, 4.9%; N, 8.5%; O, 14.6%; S, 9.8%).

Derived from C. I. Nos. 209 and 289.

No data available.

No. 284.—2-AMINO-8-TOLUENE-p-SULFO-AMINO-1-NAPHTHOL-3, 6-DISULFONIC ACID

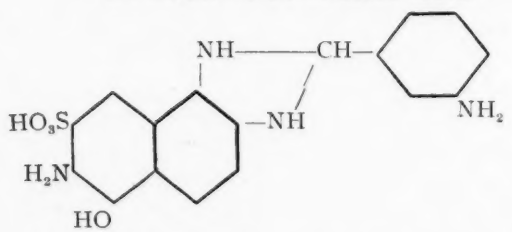


$C_{17}H_{16}N_2O_9S_2$; Mol. Wt. 456.35; (C, 44.7%; H, 3.5%; N, 6.1%; O, 31.6%; S, 14.2%).

Derived from C. I. No. 32.

No data available.

No. 285.—m-AMINOPHENYL-1, 2-DIHYDRO-NAPHTHIMINAZOLE-6-AMINO-5-HYDROXY-7-SULFONIC ACID



$C_{17}H_{16}N_4O_4S$; Mol. Wt. 372.31; (C, 54.8%; H, 4.3%; N, 15.1%; O, 17.2%; S, 8.6%).

Derived from C. I. Nos. 321 and 322.

No data available.

NOIL PRODUCES NEW ACID RED

Among the recent developments announced by Noil Chemical & Color Works is a new Acid Brilliant Red B, said to be of value in the dyeing of mode shades, such as the prevailing wine tones, on wool and silk. It is dyed on wool in the usual manner with Glauber salt and acetic acid. It is also recommended for dyeing silk piece goods. According to the description, it has excellent fastness to acids, alkalies, stoving, milling and light, and is easily dischargeable with hydrosulphite. When dyed as a self-color it produces effects described as fast to steaming in the direct printing of silk. It is useful as a shading product for other neutral or mildly acid dyeing colors.

THREE NEW NEWPORT DYESTUFFS

Under the names of Anthrene Brown BB Paste, Anthrene Violet RN Paste and Newport Chrome Orange GG, the Newport Chemical Works has placed on the market three new colors and has issued leaflets describing their properties and use.

Anthrene Brown BB Paste is said to possess excellent qualities for the dyeing of cotton in closed-type machines and open tubs. Described as very level dyeing, it is of value as a base fo drab and dark brown shades where fastness to chlor. is not essential. The other general fastness properties are claimed to be very good. It is suitable for dyeing rayon, although the resultant shades are somewhat weaker than those obtained on cotton. It is not suitable for dyeing pure silk. Printed by the reduced caustic soda method, good printed patterns can be produced on cotton.

The new Anthrene Violet is described as of value in dyeing both cotton and rayon, and as possessing excellent fastness, especially to light, chlorine, washing and water spotting. It is said further to be distinguished by good level dyeing properties and to be useful for dyeing light and medium shades and for combinations with other Anthrene colors. Metals have practically no effect upon its shades, and it can be dyed in all types of machines.

Newport Chrome Orange GG, described as a product of excellent strength, is suitable for use in the production of tan and brown shades and also as a shading color. It has very good fastness to light, according to the announcement, good fastness to fulling and excellent fastness to steaming.

INDUSTRIAL LIGHTING

Plant executives interested in improving the working conditions of their mills, offices and laboratories should derive many valuable suggestions from a set of six bulletins recently published by the Edison Lamp Works, of Harrison, N. J. Three, of a general nature, take up in turn the subjects of the lighting of offices, calculation of lighting installations, and the theory and characteristics of Mazda lamps.

Technical Notes from Foreign Sources

Treatment of Silk

The mineral content of silk may be considerably reduced, leaving at the same time a substantially neutral product, by immersing the silk in an acid solution of such pH, approximately 3.8, that the silk is brought up to an isoelectric condition. For example, 50 pounds of degummed silk are immersed in 400 liters of water of 4 degrees hardness. Dilute sulphuric acid is then added until a sample of the water just turns Bromophenol Blue yellow (pH slightly below 3.8).

The silk is centrifuged and the process repeated three times, the material being finally washed in the centrifuge with tap water until the wash water is neutral to Methyl Orange. The ash content of a sample of waste silk treated by this process was 0.71 per cent as against 3.16 per cent when the silk was degummed and washed in the usual manner. (British Patent No. 252,064).

Waterproofed Textiles

The disadvantages that are associated with the production of waterproofed fabrics by the action of concentrated solutions of metal chlorides, are done away with by adopting the process patented in British Patent No. 251,126.

In this process the material is dried before entering the bath, and on leaving it is scraped on both sides, squeezed to remove superfluous chemicals and passed over a heating drum to assist amyloid formation. The material is then immediately cooled and passed into the first of a series of washing baths, after which it is subjected to a number of sprays in such a manner that the sheet is not broken. When completely washed, it is dyed or otherwise treated and slowly dried.

Contraction of Cellulose Fibers on Mercerization

Expressions are developed for the contractive force operating on cellulose during mercerization. The assumption is made that the fibers consist of cylinders of an amorphous cementing substance in which regularly oriented liquid crystallites are dispersed. By making certain assumptions the contractive force is calculated for cases where the crystallites are parallelopipeds, cylinders, ellipsoids or cones, and in all but the last, which is held to be an improbable shape, the value obtained is of the order of magnitude of that observed. For further details the reader is referred to Kolloid Zeitung, 1926, volume 39, pages 107 to 110.

Printing Dado Effects in One or More Colors

Fabric is printed with a dado ground, for example, ruled with fine lines, by means of a color paste which contains no mordant. The fabric is then dried and overprinted with a mordant and steamed. These operations can also be carried out in the reverse order. The fabric is then washed and soaped in the usual manner, color being fixed only in those parts covered with the mordant. Red or pink, puce and violet effects are obtained by means of alizarine and aluminum, chromium and iron mordants, respectively.

Similar blue effects are obtained by printing first with ketone blue and then overprinting with a solution of sodium hydroxide of 1.16 to 1.18 density. The fabric is afterwards washed and soaped. Multicolor effects are obtained by overprinting a mordant on a fabric previously printed in several colors with, for example, alizarin for pink, garnet and violet: extract of Persian berries for yellow; alizarin viridine for green; Persian berry extract and alizarin viridine for olive, etc.

Black effects are obtained by means of logwood and a chromate, ferricyanide, or a salt of iron, or with a mixture of alizarin Bordeaux. Persian berry extract, and an iron mordant. Tinted grounds are produced by addition of a suitable coloring matter to the mordant, printing paste. (Bulletin Societe Industrielle Mulhouse, 1926, volume 92, pages 161-162.)

Bleaching Hair for Hat Making

The greatest portion of the hair used for hat making is bleached in the form of loose material. There are two sorts of bleaching operations: one known as the reducing bleach and the other as the oxidizing bleach, the latter yielding a more lasting and purer white. Hydrogen peroxide or sodium peroxide is used for this purpose. Sulphur and bisulphite are employed in the reducing bleach or bisulphite and permanganate.

From 5 to 7 liters of the hydrogen peroxide, 30 per cent solution, in 100 liters of water are used for bleaching hair. The ammonia necessary to make the liquor slightly alkaline is added and it has also been found advisable to add some water glass. The liquor is heated up to the temperature of 40 to 50 deg. Cent. and then the hair is introduced. The liquor is agitated for some time and then the hair is allowed to remain in it overnight. If the results are satisfactory, the material is soured with 2 per cent of 66 deg. Be. sulphuric acid, figured on the weight of the material. The latter is well washed and dried in the air.

A cheaper bleaching agent is sodium peroxide, the bleach liquor in this case containing 100 liters of water, 1.35 kilograms of 66 deg. Be. sulphuric acid and one kilogram of sodium peroxide.

The reducing bleach by means of sulphur is carried out in the customary manner. Chambers are employed in which the sulphur is volatilized.

Bleaching with potassium permanganate requires two solutions, one of the permanganate and another of sodium bisulphite. The first solution contains 150 grams of the permaganate to 100 liters of water and the material is treated therein for three-quarters of an hour at a temperature of 30 deg. Cent. Then it is washed, squeezed and introduced into the second liquor which consists of 100 liters of water, 1 liter of 40 deg. Be. solution of sodium bisulphite and 300 grams of 66 deg. Be. sulphuric acid. Thereafter the hair is washed and dried at the ordinary temperature. (Deutsche Faerber Zeitung, 1926, 777-8.)

Dyeing Leather

The dyeing of leather is difficult owing to the variations in the properties of one hide to the other, and also to variations which exist in one and the same hide. Furthermore, the superficial layer of the hide, which behaves differently from the underlying layer opposite to the color, gives rise to iridescence phenomena which are troublesome.

There are therefore great technical difficulties surrounding the dyeing of a hide to match a sample, so that a uniform and non-bronzed shade is obtained. Moreover the dyeing of the hide in colors shows all the defects in the hide, while the dyeing in black tends to hide them. This is why hides are dyed with pigment colors, for these have the advantage of hiding the defects in the skins.

The properties of dyed skins and leathers that are prescribed are great resistance to the action of light and to friction. Furthermore the dyestuff must have penetrated sufficiently deep into the hide so that the color does not bleach out when the hide is subjected to strong tension, which opens the grain, operations of the kind that take place in the making of shoes or gloves.

Soft colors are most always used on shoe and glove leathers. This is why the dyeings are always the result of the formation of one or more superimposed lakes obtained either by combination of a natural coloring matter, or if a tannin, with a metallic oxide, or by the combination of an acid color with a metallic oxide, or by the combination of a bacis color with tannin, or finally of an acid color with a basic dye.

Bright shades are sought only in certain special cases in the dyeing of morocco leathers, and then it is advisable to avoid as far as possible the formation of metallic lakes.

The sulphur colors are not employed in the dyeing of leathers, for the reason that sodium sulphide must be employed in dissolving them. The alizarin colors are used but little, their lakes with metallic oxides being formed generally at too high temperatures.

After the leathers have been dyed, dried, grained and softened by various mechanical operations, a finish coat is applied to their surface which consists of treatment with solutions of egg and blood albumen. This materially improves the character of the surface and renders the article more merchandisable. (Revue Generale Matieres Colorantes, 1926, page 373.)

Mordanting and Dyeing of Wool

The general methods that have been used up to the present time for the mordanting and dyeing of wool with the aid of chromium salts consists in the continuous use of a chrome solution of suitable composition and as the chromium salt was absorbed from this solution by the woolen fiber new salt was added to replace it. It must be clear that the mordanting of wool in this manner cannot give a uniformly mordanted product. Aside from the fact that the quantity of chromium salts in the bath varies, the acid content of the mordanting liquor is also not constant, as increasing quantities of alkali are added to the liquor from the freshly washed wool.

On this variation has been placed the blame for the production of colors with logwood, for example, which are not fast to light or to potting, for this natural dyestuff is known to give perfectly fast shades when mordanted with the correct amount of chromium salt. It has also been established that the mordanting of wool can be carried out in the presence of hydrochloric acid and the dyeing of the mordanted wool thereafter, all in one bath. However, up to the present time it has not been practical to use logwood in such a manner, for it has been thought necessary to have two baths available for dyeing with this natural dyestuff.

It is a fact that the chromium mordanting of wool is effected in such a manner that all the chromium salt is well fixed on the fibers and is not precipitated in the dye liquor. Hydrochloric acid is not suited for this purpose when used alone, although a large excess of the acid may be employed, which is, of course, too wasteful a procedure for practical application. The same condition applies to the other acids, tartaric acid, formic acid and lactic acid. But when a mixture of lactic and hydrochloric acid is employed, a very good mordant is obtained, and this liquor will give a well mordanted fiber to which the chromium salts will adhere very tightly.

The mordant itself is made in the following manner: One part of sodium bichromate is mixed with one and one-half parts of lactic acid (50 per cent strength), one part of hydrochloric acid (32 deg. Tw.), the figures being based on 100 parts of wool to be mordanted. The mixture is heated for approximately three-quarters of an hour to the boiling point. The chrome salt present in this mixture is sufficient to yield a deep bluish black with logwood. When it is desired to produce an even deeper and more intense black, then the proportion of the dichromate may advisedly be

raised to 2 per cent, and the same increase should be made in the proportions of the hydrochloric acid and lactic acid. One per cent of the chromate, however, is sufficient for all ordinary purposes, and this therefore means that there is a considerable saving of this salt in comparison with the ordinary two-bath method.

After the mordanting is completed, the material is made weakly alkaline by the addition of ¼ to ½ per cent of sodium carbonate, and this also results in the decomposition of all the chromium salt that remains. After an additional period of five minutes has elapsed, the required proportion of logwood is added or any other suitable mordant coloring matter. The bath is then made weakly acid with acetic acid or other suitable acid. The dyeing is carried out at the boiling temperature for a period of approximately three-quarters of an hour. After the dyeing operation is concluded, it will be found that there are no traces of undissolved precipitate in the color liquor. (Der Textilchemiker und Colorist, 1926, pages 94-5.)

Color Effects on Vegetable Fibers with Alumina Colors

A part of the vegetable fiber is mordanted with the aid of the sulphurization products of phenol or its homologues and substitution products, as well as the condensation products of the phenols with aldehydes or the products obtained by the action of sulphites on such sulphided substances. The fiber is treated either in the loose condition or as skeins of yarn. Thereafter the fiber is woven together with unmordanted fiber into the fabric and the fabric is dyed.

Thus, for example, cotton which has been mordanted with phenol sulphurization products is interwoven with non-treated cotton, and then mordanted with a weak solution of phenolic sulphurization products. Then the fabric is washed and thereafter it is dyed with basic coloring matters. This results in the production of a colored fabric in which certain parts appear lighter dyed than others. (German Patent No. 428,039.)

Insoluble Azo Dyes on the Vegetable Fiber

The fiber is dyed with azoxy or azo derivatives of 2:3-oxynaphthoic acid arylides in alkaline solution. The material is washed and the color is developed on it by diazotization. The azoxy and azo derivatives of 2:3-oxynaphthoic acid, which are easily prepared from 2:3-oxynaphthoic acid nitro arylides, possess so great an affinity for the vegetable fiber that they can be used in the dyeing process just as if they were substantive coloring matters. Very deep colors are obtained after development by diazotization and the shades are marked by their high fastness to rubbing. (German Patent No. 422,467.)

Prevention of Injury to Printing Rollers

German Patent No. 428,303 is concerned with a method for protecting the printing rollers from the action of color pastes which might contain ingredients that are injurious to them. Thus color pastes are prepared with highly viscous mineral oil and tar oil ingredients, and such materials as paraffin and wax which serve to increase the viscosity of the paste. Thus the mixture may consist of the following and no bad results will be found on the engraved rollers: One part of paraffin, 6 parts of mineral oil, 3 parts of heavy benzine (to prevent foaming) or 1 part of ricinoleic acid, added for the same purpose, the mixture being used to the extent of 90 grams per kilogram of coloring matter.

Chemical Processes in the Ripening of Viscose

Sodium hydroxide and carbon disulphide react according to the equation:

$$5CS_2 + 12NaOH = Na_2S + 3CS(SNa)_2 + 2Na_2CO_3 + 6H_2O.$$

By the action of acid one molecule of sodium sulphide yields one molecule of sulphuretted hydrogen, and the three molecules of sodium trithiocarbonate yield three molecules of hydrogen sulphite and of carbon disulphide. If by treating viscose with acid *a per cent* of hydrogen sulphide and *b per cent* of carbon disulphide are obtained, one-quarter of *a* rises from sodium sulphide and three-quarters of *b* from sodium trithiocarbomate, which latter also gives an equal molecular amount of carbon disulphide which was combined with cellulose. During the ripening of viscose the xanthate is slowly hydrolyzed and the dithiocarbonic acid residues thus formed react with sodium hydroxide. The differences in the amounts of carbon disulphide liberated by acid at different stages of ripening are only two-fifths of the amounts produced by the decomposition of the xanthae. The differences are so small that an illusory constancy of the ratio of carbon disulphide to cellulose is obtained. (Kunstseide, volume 7, page 286 ff.)

Absorption of Methylene Blue from Buffered Solutions in Chemical Analysis of Cotton

It has been shown that a measurement of the absorption of Methylene Blue by cotton is profoundly influenced by the presence of traces of acids or alkalies. This is now ascribed to a hydrogen ion effect and the test, for analytical purposes, is simplified by having a phosphate mixture in the dye solution so that neutrality (pH7) is maintained automatically. The effect of hydrogen ion concentration has been studied particularly with modified celluloses.

The absorption of oxylcelluloses falls rapidly as the acidity of the mixture increases. The product obtained by drying sulphuric acid into cotton also absorbs Methylene Blue freely, but in this instance the absorp-

tion does not fall as the acidity increases. Using a buffered solution for the oxycelluloses and a solution containing free acetic acid for the other product it is thus possible to distinguish between two common types of cellulose modification which may be encountered in bleaching, even when present in the same material. Some experiences of the quinhydrone electrode for determining hydrogen ion concentration in Methylene Blue solutions are described.

Experiments on the absorption of Methyl Green and Malachite Green by caustic scoured cotton and the effect of the alkali present (recorded as ash alkalinity) are also described. With these dyes it was obvious that much of the apparent absorption was due to precipitation of the colorless dye bases by the free alkali present. When the ash alkalinity was reduced to a minimum by washing with acid the absorptions fell into line with those recorded for Methylene Blue, diminishing as the severity of the scouring treatment increased.

For further details see Journal of the Textile Institute, 1926, volume 17, pages T 127 to 144.

Comparison of the Hot Bleach and the Mohr Bleach Process

The Mohr process of bleaching in which cellulosic textile materials (fabric may be treated in the open width) are successively bleached under a hydraulic pressure of from two to three atmospheres in the same container with a chlorine bleaching solution, then soured and bleached again, and afterwards thoroughly washed is more economical in labor and particularly time than the usual processes of kiering and bleaching with hypochlorites. In the second bleaching operation carried out in this process the bleach liquor contains a peroxide. Cold or warm liquors may be employed. The textile material suffers only a small loss in weight and is uniformly and thoroughly purified so that it is very absorbent and takes up dyes evenly.

In the second article on this subject the aforementioned advantages are refuted. It is stated therein that the Mohr process removes pectic and protein impurities from the cotton, but only partially the fats and waxes. The last-named impurities retard rapid penetration of the cotton by the bleaching liquors so that the use of excess of bleaching agents is necessary. A considerable amount of oxycellulose is thereby formed. Cotton bleached by the Mohr process becomes yellower after extraction with light petroleum and the extracted cotton becomes still yellower when steamed.

The yellowing of the bleached cotton during storage is hindered by the presence of the fats and waxes incompletely removed during bleaching. Cotton fabric suffers a 5 per cent loss in weight during bleaching by the Mohr process, whereas the "hot bleach" process of Thiers-Herzig produces a loss of 12 per cent. Fabric bleached by the Mohr process thus contained impurities which are revealed by dyeing it with alizarine. The Mohr process of bleaching produces an excessive loss of strength and is really but a partial bleach which can be better obtained by the usual methods or in less elaborate plant. (Textilberichte, volume 6, pages 909 to 912 and volume 7, pages 226-227.)

Bleaching Artificial Silk with Activin

Activin is a satisfactory substitute for hypochlorites and the like in the bleaching of viscose silk. Raw silk is bleached to a uniform pale cream shade without deterioration by treatment with a 3 to 4 per cent solution of activin at a temperature of 60 to 70 deg. Cent. The resulting loss of activity of the activin is strictly proportional to the amount of bleaching effected, and the residual liquor may be used again after titration with the aid of potassium iodide and sodium thiosulphate and addition of a suitable amount of activin.

White is obtained by bleaching with a 0.3 per cent solution of activin containing ½ per cent of a 50 per cent solution of acetic or formic acid. Under these conditions the bleaching solution is slightly cloudy owing to the separation of para toluene sulphonchloramide, but no deterioration of the bleached silk occurs even when high temperatures are employed. Viscose silk materials bleached by means of activin have a more uniform affinity for dyestuffs than those bleached by other methods. (Melliand's Textilberichte, 1926, volume 7, pages 47-8.)

Dyeing Non-Denitrated Nitrocellulose Silk

Nitrocellulose silk absorbs ortho-nitraniline and benzamide from aqueous solutions in accordance with Henry's law, subject to correction in the case of benzamide for the molecular association which it suffers in concentrated aqueous solution. The solubilities of ortho-nitraniline and benzamide in nitrocellulose silk are 250 and 30 times greater respectively than their corresponding solubilities in water. One gram of nitrocellulose silk is capable of absorbing or dissolving a maximum of 1.25 grams of ortho-nitraniline but absorbs only 0.9 gram when immersed for a period of one and one-half months in an aqueous solution maintained saturated with ortho-nitraniline.

Nitrocellulose silk behaves similarly to cellulose acetate silk in respect to its absorption of ortho-nitraniline from aqueous solution and its affinity for feebly basic and non-sulphonated dyes. Cotton cellulose nitrated so that it contains 12 per cent of nitrogen behaves similarly to nitrocellulose silk. (Textilberichte, 1926, pages 29, 31.)

The Department of Commerce has just announced that total wool and wool manufactures exported in August were valued at $10,619,016, as compared with $19,075,839 in August, 1925. Manufactures comprised $5,706,590 of the total.

RECENT PATENTS

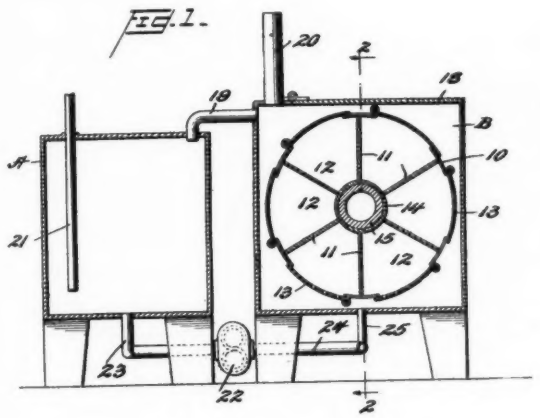
Dyeing Apparatus

(1,589,668; June 22, 1926)

Francis C. W. Stelter, Long Island City, N. Y.

The present invention relates to machines for dyeing, washing and rinsing fabrics and other materials, particularly garments, hosiery, hats and other wearing apparel, also thread and yarn.

The object of the invention is to produce a machine in which a number of different articles, or batches of articles, may be kept separated and treated at the same time, and in which the dye liquid is circulated through the articles, the liquid being so directed that it will keep the articles from clinging together and thus secure uniform results.



The invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a sectional end view through a storage and mixing tank and an associated dyeing machine.

Fig. 2 is a vertical sectional view on the line 2—2 of Fig. 1.

Referring to the drawing, A indicates a storage and mixing tank in which the dye may be mixed and heated before passing to the dyeing machine, and B indicates the dyeing machine proper. The tank A may be of wood or metal, and the tank B is preferably constructed of sheet metal.

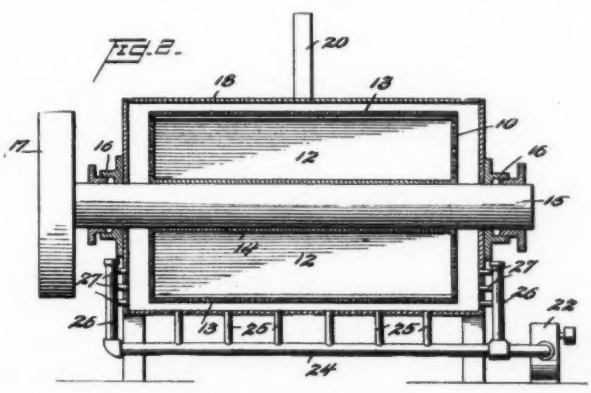
Within the tank B is a cylinder 10 having perforated cylindrical end walls. The cylinder is provided with radial partitions 11 which divide it into compartments 12, and each compartment has an opening in its circular wall provided with a door 13. The radial walls 11 preferably terminate in an inner cylinder 14 whereby acute angles at the bottoms of the compartments are avoided. The cylinder is mounted on a shaft 15, which in turn is mounted in suitable bearings 16 on the ends of the tank B and provided with a suitable pulley or gear 17 by means of which the cylinder can be slowly rotated.

The tank B is provided with a lid or cover 18 and with an overflow pipe 19 through which dye liquor is returned to the tank A. The dye tub or tank may also be provided with an air vent 20. Steam may be conducted into the tank A through a pipe 21 to keep the dye liquid at a proper temperature.

In the operation of the machine, the dye liquid is continuously circulated from the tank A to the tank B and returned to the tank A, this being accomplished by a suitable piping and a pump 22. The pump takes liquid from the tank A through the pipe 23 and delivers it through pipe 24 and through a series of nozzles into the bottom and ends of the tank B. As shown, the pipe 24 extends along under the bottom of the tank B in a central position and it is provided with a series of branches or nozzles 25 through which the liquid is directed vertically upward under the middle of the cylinder. The currents of liquid from the nozzles 25 strike the perforated outer wall of the cylinder and cause upward currents in the several compartments as they pass over the nozzles, thus circulating the dye liquid through the articles under treatment and keeping them from accumulating in masses, which would prevent proper dyeing.

The pipe 24 is also provided with upwardly directed branches 26 at the ends of the tank B, these branches being provided with nozzles 27 through which the liquid is forced against the perforated ends of the rotating cylinder, part of the liquid passing through the perforations and assisting in circulating the fluid therein.

It will be evident that the structure described is simple and inexpensive, and that in operation it will accomplish the purposes set forth; that is, it will continuously supply dye liquid to the tub or tank B and keep the articles being dyed in suspension and agitation, whereby uniform results are obtained. The dye may be drawn off and other dye substituted, or water for washing purposes may be injected into the tank B by suitable piping and valves, which it is not necessary to describe, as such arrangements are well known.



APPOINTMENT OF CHEMICAL MAN TO NEW YORK DISTRICT OFFICE

It will be of distinct interest and of great assistance to the chemical industry and to the exporters primarily to know that Richard J. Flood, Jr., who has been associated with the Chemical Division in Washington for the past twelve months, has been transferred to the New York district office, 734 Custom House, to devote his entire time to attending to the wishes and wants of chemical interests located within the New York district. The department endeavors to facilitate the distribution of information and the answering of inquiries, and it is felt that the allocation of Mr. Flood, specially detailed to handle chemical matters, will be a real step forward in this direction.

MANCHESTER PLANS CHEMICAL EXHIBITION

An exhibition is being organized on behalf of the Manchester section of the Society of Chemical Industries, supported by the Coke Oven Managers' Association, the Institute of Gas Engineers, and kindred organizations, to be held in Manchester, England, November 16 to 27, 1926. The scope of the exhibition will embrace all coal-tar products, dyes and colors, fuels and heavy oils, industrial and fine chemicals, instruments, plants for purification, carbonization and treatment of coal, and chemical engineering plants of all kinds. American manufacturers having offices or representation in England are eligible to participate.

RAYMOND V. ROCHE

Members of the American Association of Textile Chemists and Colorists will be sorry to learn of the death of Raymond V. Roche, manager of the application laboratories of the National Aniline & Chemical Company, Buffalo, in a recent automobile accident.

F. E. ATTEAUX & C. TO CONTINUE UNDER PRESENT MANAGEMENT

Friends of the late Frederick E. Atteaux will be glad to know that the business which bears his name will continue to be carried on by the present board of directors along lines which governed it during the years of Mr. Atteaux's activity.

The only change, which is of course necessitated by Mr. Atteaux's death, will be that one of the present directors will shortly be elected president of the concern.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

COLOR MIXER

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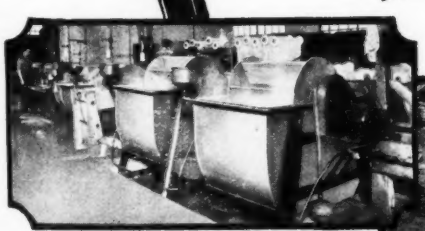
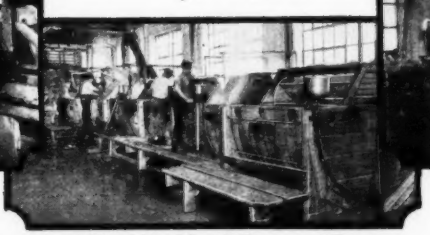
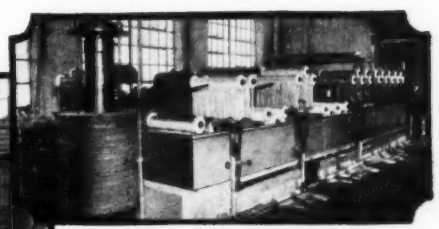


Emil Schaefer Monel Metal, paddle type, Hosiery Dyeing Machines.



Monel Metal-lined Smith-Drum, paddle type, Hosiery Dyeing Machines. All equipment shown is installed in F. A. Tomalino Silk Dye Works, Phila.



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Sandoz Chemical Co.	IX
Society of Dyers and Colourists	—
Solvay Process Co.	—
Southern Textile Exposition	Third Cover
Suter, Alfred	—
Textile Finishing Machinery Co.	Second Cover
Tolhurst Machine Works	IV
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United Chemical Products, Inc.	VIII
U. S. Color & Chemcal Co.	XV
Vellner, Eugene	—
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ANTIMONY SALTS
CRUDE AND HALF REFINED TARTAR
ANTIMONY LACTATE
ACETATE OF CHROME
FLUORIDE OF CHROME
ACETATE OF IRON
NITRATE OF IRON
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DYEWOOD EXTRACTS
TANNING EXTRACTS

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Works: Mansfield, Mass.

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INCORPORATED

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Sole New England Agents for Lactamine and Violamine

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New England Agents for the
FADE-OMETER
Manufactured by
ATLAS ELECTRIC DEVICES CO.

SEVENTH SOUTHERN TEXTILE EXPOSITION

TEXTILE HALL :: :: GREENVILLE, S. C.

November 1st to 6th Inclusive, 1926

The Exhibitors and Directors of Textile Hall Corporation cordially invite you to attend the Southern Textile Exposition, to be held in Textile Hall, Greenville, S. C., November 1st to 6th, 1926.

The Directors of Textile Hall Corporation and the Exhibitors cordially invite the manufacturers of the Nation and the members of their organizations to attend the Southern Textile Exposition, to be held in Textile Hall, Greenville, S. C., November 1st, to 6th, 1926.

Attractive displays will be made by the leading manufacturers of textile machinery, equipment, accessories and supplies. The latest inventions and improvements will be shown.

An important feature will be the Club Room for executives, superintendents, overseers and other patrons. It will be exclusively for men. Writing tables, market reports and other things will be provided.

Capable committees, well trained by six previous successful expositions, will handle the entertainment and other items of the program, in which all Greenville citizens will co-operate. The Autumn convention of the Southern Textile Association will be held during Exposition week.

The hotels and homes of Greenville are equal to housing the large number of visitors who will attend. Please address Reservation Committee, 711 North Main Street, for prompt service.

Executives in other lines than the textile industry will find the Southern Textile Exposition interesting. The exhibits of motors, power transmission equipment, anti-friction bearings, lubricants, paints, and many other things used in all factories will be extensive.

Opening Day November 1st

"DYE HOUSE FOG"

The Enemy of Profits

Stop the Leakage NOW—

"Dyehouse Fog" is the enemy of profits. The losses that it causes are not intermittent, but continuous. As long as you tolerate fog in your dyehouse you cannot escape them.

But you do not have to tolerate it. The Franklin Process Raw Wool Dyeing Machine will eliminate it. This machine dyes under pressure *in a closed kier.*

Consider the savings made possible by this improved method of raw stock dyeing. No rotted wood, rusted or corroded metal, or loosened brickwork caused by free steam. Every ounce of steam is kept at work. This method of dyeing also makes it possible to operate at 25 to 30° lower temperature than by other methods, practically eliminating all danger of tendering the stock.

Special time-saving features enable one operator, with two helpers for loading and unloading only, to run a battery of five Franklin Process Raw Stock Dyeing Machines, turning out 5000 pounds per day on chrome colors and more on mixed and union colors.

The story of the savings effected through the use of Franklin Raw Stock Dyeing Machines is told in our booklet, "An Idea — And What Came of It." Send for a copy to-day.

Several mills tell in this booklet, their experience with Franklin Process Raw Stock Dyeing Machines.

It's an exceptionally interesting story. A copy will be mailed to you, on request, free of all obligations.

The illustration above shows a battery of Franklin Process Raw Stock Dyeing Machines in operation in a well-known New England mill. Note the absence of dyehouse fog.

FRANKLIN PROCESS COMPANY

Manufacturers of Dyeing Machines, also Yarn Dyers and Manufacturers of Glazed Yarns

PROVIDENCE, RHODE ISLAND

AMERICAN
DYESTUFF
REPORTER

GEIGY

NEW SILK-CLEAN
Chrome Silk Brown No. 1
Chrome Silk Black B

CHROME COLORS
Possessing all the Fastness
Essential

FOR PIECE-GOODS
and Good Fastness
to Light

Celanese Brand Yarn
Requires Setacyl
Direct Colors Powd.

In U. S. and Canada.
Sole Selling Agents for
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GEIGY COMPANY Inc.
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THE GEIGY COLOUR CO., LTD
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Branch Works at Clayton

Established 1764—J. R. GEIGY S. A.—Manufacturers of dyestuffs since 1859

Several mills tell in this booklet, their experience with Franklin Process Raw Stock Dyeing Machines.

It's an exceptionally interesting story. A copy will be mailed to you, on request, free of all obligations.

The illustration above shows a battery of Franklin Process Raw Stock Dyeing Machines in operation in a well-known New England mill. Note the absence of dyehouse fog.

"FOG"

The Fuel Thief — Banish It From Your Dyehouse

"FOG" in your raw stock dyehouse means a continuous waste of fuel and a constant drain on your pocketbook.

It is no longer necessary to have this enemy of profits in your dyehouse. Franklin Process Raw Wool Dyeing Machines will absolutely eliminate it, as they dye under pressure *in closed kiers*. The fuel saving thus effected is very important.

As 25 to 30° less heat is required for Franklin Process Machines than for other methods, there is also much less danger of tendering the stock. Production is increased. In one instance, a single operator, with two helpers for loading and unloading only, runs five Franklin Process Machines, turning out 5000 pounds of chrome colors per day.

Improved dyeing results from the Franklin pressure method of forcing the liquor through the stock. The flow is in one direction only, while the stock remains stationary. Consequently felting is prevented and the stock is left in excellent condition for following operations.

The complete story of how Franklin Process Raw Stock Dyeing Machines eliminate "fog," lessen fuel consumption, and improve and speed up dyeing, is told in our booklet, "An Idea — and What Came of It." You will find it interesting and profitable reading. Send for a copy to-day. No obligation.

FRANKLIN PROCESS COMPANY

Manufacturers of Dyeing Machines, also Yarn Dyers and Manufacturers of Glazed Yarns

PROVIDENCE, RHODE ISLAND

WE ANNOUNCE this month the production of five new products, all of which are of the high standard exemplified by the American Aniline Seal.

Amanil Developed Black O B

For cotton and rayon material requiring excellent fastness to washing.

Amandone Red B Powder and Paste

The first Thio Indigo color of our manufacture and with others soon to follow will give us an enviable line of the three important classes of Vat Dyes.

Amacid Milling Scarlet 3R

Identical to the pre-war product and in addition leaves cotton cleaner than many other brands.

Amacid Milling Scarlet R

Identical in properties to the 3R brand but much yellower in shade.

Amanil Naphtol A S

Identical with its well known prototype.

American Aniline Products, Inc.

45 EAST 17th STREET, NEW YORK, N. Y.

Offices: Boston, Mass.
Philadelphia, Pa.
Chicago, Ill.
Charlotte, N. C.

Works: Lock Haven, Pa.
Nyack, N. Y.

SOLVAY
ANCHOR BRAND
SODA

SOLVAY

STANDARD IN
SODA
SINCE 1881

SOLVAY products are sold on the basis of *actual* Alkaii content.

SOLVAY 58% Soda Ash *contains* 58% of *actual* sodium oxide.

SOLVAY 76% caustic soda *contains* 76% of *actual* sodium oxide.

Specify SOLVAY—the standard in SODA since 1881.

The Solvay Process Company

Detroit, Mich. Syracuse, N.Y. Hutchinson, Kans.

WING & EVANS, Inc.
40 Rector Street

Sales Department
New York

Boston Cincinnati Cleveland Detroit Pittsburgh
Chicago Syracuse Indianapolis Philadelphia
St. Louis Kansas City

Established 1895

BOSSON & LANE

Manufacturers of

The Original

BLEACHING OIL

for boiling out Cotton, to produce a foundation for a Pure White

High Grade Sulphonated and Saponified

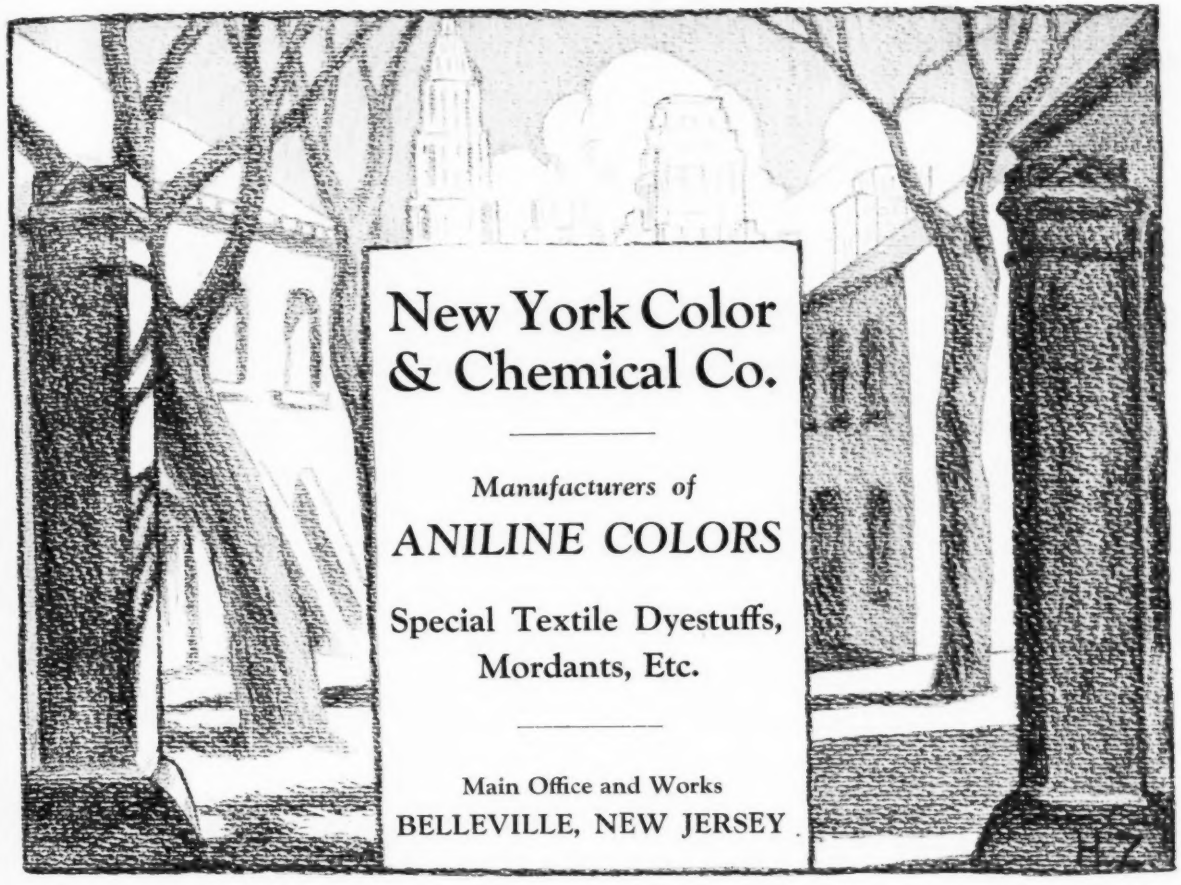
CASTOR OIL PRODUCTS

Para Soap Oil

Solvents and Assistants for cleaning all Textiles

B & L Bleachers' Bluings and Tints

Works and Office, ATLANTIC, MASS.



Are you on the list ?

IF you are on the list of those regularly using *Camel Dyes* you know there is hardly a fabric or fibre that you can't dye right, as fast as it should be dyed, and matched in shade as it should be matched.

CAMEL DYES

Aceko (Acid)
Ethonic (Level Dyeing Acid)
Amidine (Direct)
Sol-Amidine (Light Fast Direct)
Amalthion (Sulphur)
Kromeko (Chrome)

Samples, technical advice and practical assistance gladly furnished

JOHN CAMPBELL & COMPANY

75 Hudson Street *American Dyestuff Manufacturers* New York, N. Y.

Branches and Warehouses: Boston; Chicago; Providence; Philadelphia; Toronto, Ont.

"STANDARDS EVERYWHERE"

SANDOZ

NOVO FERMASOL

A stable and highly concentrated Desizing Compound
in Powder form.

DISSOLVES VERY EASILY AND COLORLESS

Very economical in its application and assures perfect
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COTTON, RAYON OR MIXED GOODS

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Announcing our new product:

DIAZO BLACK B H X Conc.

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We also manufacture and recommend

DIRECT FAST BLACK L
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OILS, SOFTENERS and TEXTILE SPECIALTIES

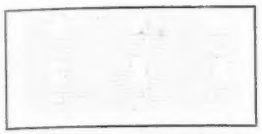
CHARLOTTE, N. C. CHICAGO, ILL. PAWTUCKET, R. I.

VII

CHLORANTINE FAST COLORS

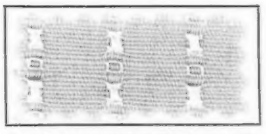
ON

COTTON AND RAYON MIXTURES.

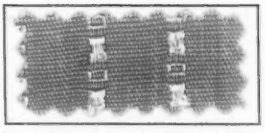


0·1 % Chlorantine Fast Yellow RL.

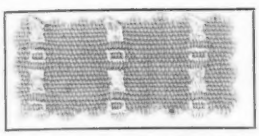
0·1 % Chlorantine Fast Orange 2 RL.



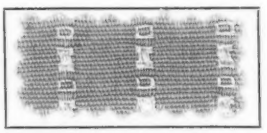
0·2 % Chlorantine Fast Brown RL.



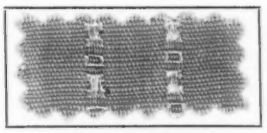
0·2 % Chlorantine Fast Brown BRL.



0·2 % Chlorantine Fast Blue 8 GL.

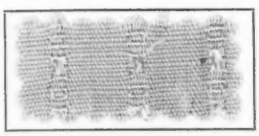


0·2 % Chlorantine Fast Blue 4 GL.



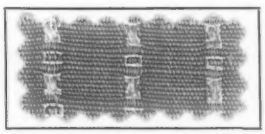
0·2 % Chlorantine Fast Grey RLN.

2 % Chlorantine Fast Blue 2 GL.



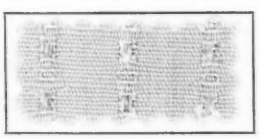
0·1 % Chlorantine Fast Red 5 BL.

0·1 % Chlorantine Fast Violet 2 RL.

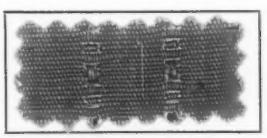


0·1 % Chlorantine Fast Violet BLN.

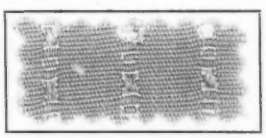
0·2 % Chlorantine Fast Violet 5 BL.



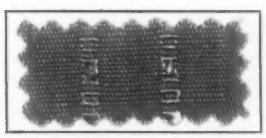
0·1 % Chlorantine Fast Grey GLN.



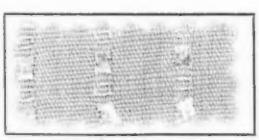
0·45 % Chlorantine Fast Green BL,
0·05 % Chlorantine Fast Brown BRL.



0·2 % Chlorantine Fast Green BL.

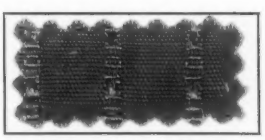


2 % Chlorantine Fast Green BL.



0·07 % Chlorantine Fast Grey GLN,
0·03 % Chlorantine Fast Brown BRL.

0·4 % Chlorantine Fast Brown BRL,
0·2 % Chlorantine Fast Grey GLN,
0·1 % Chlorantine Fast Yellow RL.



0·3 % Chlorantine Fast Brown BRL,
0·1 % Chlorantine Fast Orange 2 RL,
0·1 % Chlorantine Fast Grey GLN.

5 % Chlorantine Fast Brown BRL,
1 % Chlorantine Fast Grey GLN,
1 % Chlorantine Fast Yellow RL.

Unexcelled in Fastness to Light.

CIBA COMPANY INC.

NEW YORK, N. Y.

Atlantic GA., Boston, Chicago, Greensboro, Philadelphia, Providence, San Francisco.

Made in Switzerland. *p. f. o.*

Dyeing Instructions.

The well wetted material is dyed with:

2 % Olive Oil Soap,
1 % Hydroexamine or Tetracarnite

for 10—15 minutes at 140—170° F.

Then add:

for pale shades: 10 % Glaubersalt crystals,
for medium and dark shades: 20—30 % „ „
and dye for 10—15 minutes at the same temperature.

Increased additions of Glaubersalt and higher temperatures cause deeper shades on the Rayon.

Quick matching is essential for good results.

— Without Guarantee. —

for

Cotton and Rayon Mixtures

CHLORANTINE FAST COLORS

THESE colors possess the prime requisite for successful dyeings of Cotton and Rayon Mixtures—*unusual fastness* to light.

In level dyeing, where fastness to acid, alkali, rubbing and hot pressing are required, their good qualities commend themselves to exacting users.

Sample dyeings on Cotton and Rayon Mixtures are shown elsewhere in this issue. An inspection will reveal the effectiveness of Chlorantine Fast Colors for your textiles.

The unusual fastness properties of Chlorantine Colors also give Upholstry Goods, Casement Cloths, Curtains, Velveteens and Linen Plush unsurpassed resistance to light.

Sole Representatives in the United States for the
SOCIETY OF CHEMICAL INDUSTRY IN BASLE
Basle, Switzerland

Ciba Co. Inc.
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Sole Selling Agents for
DOW'S INDIGO
and
MIDLAND VAT BLUES

AMERICAN DYEWOOD COMPANY

BLACK
the
Color of Dignity

LOGWOOD BLACK

possesses
depth of shade
quality of tone
fullness and
bloom

These desirable qualities are unexchangeable under all conditions of light—Morning—Noon—Night.

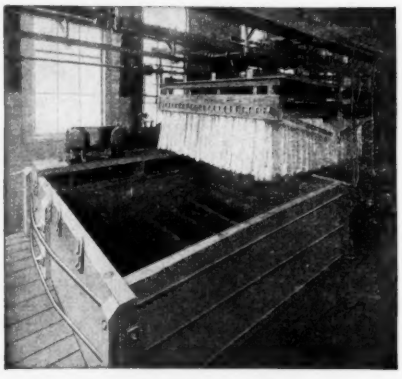
Production cost lowest

AMERICAN DYEWOOD COMPANY

MAIN OFFICE: 100 EAST 42ND STREET
NEW YORK, N. Y.
WORKS: CHESTER, PA.

BOSTON PHILADELPHIA MONTREAL

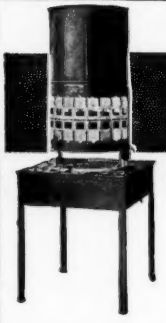
Cotton, Wool and Worsted Skein Dyeing



Machines for 600-lb. to 1,000-lb. batches.
Driven by split cluches or motors and silent chains, running in oil, with electric push button control.
With these our standard for uniformity in dyeing is fully maintained.

Patentees and Sole Manufacturers

Hussong Dyeing Machine Co.
GROVEVILLE, NEW JERSEY



Will it Fade? Ask the
FADE-OMETER
Standardized Sunlight

The Increasing Insistent Demand for Sunfast Colors

The Fade-Ometer is the ideal instrument, for it is the manufacturer's greatest aid in meeting the increasing demand for sunfast colors. The Fade-Ometer is built to run day and night, winter and summer, so that all jobs can be given a "rush" test before they leave your plant.

Send for information Bulletin No. 12 E.

Atlas Electric Devices Co.
364 W. Superior St. Chicago, Illinois

New York
F. Schlayer
25 Howard Street

London
Kelvin Bottomley & Baird, Ltd.
51/52 Fenchurch St., E. C. 3

Boston: S. R. David & Co., 252 Congress Street

Do You Dye Rayon?

Then by all means you should have this folder

—In it are described in full detail the many features of the Klauder-Weldon Skein Machine for Dyeing Rayon, Mercerized Cotton and Silk.

This one machine can be equipped for dyeing all three of these products in skein form.

A table giving styles of machines, capacity in pounds, floor space required—width and length—horsepower, and pulley size is incorporated in the folder.

And remember this about not only the skein dyeing machines, but *all* Klauder-Weldon machines—that they always live up to what was promised for them—quality and quantity. To insure this, we supervise the erection of the skein dyeing machine and place a man in your plant until your own organization can operate it at its greatest efficiency, and prove to you its superiority over any other form of skein dyeing.

KLAUDER-WELDON DYEING MACHINE DIVISION
H. W. BUTTERWORTH & SONS CO.
BETHAYRES, PA.
Philadelphia, Pa.; Providence, R. I., and Charlotte, N. C.

BUTTERWORTH
Finishing **MACHINERY**

Let us help you solve your stream pollution problem

DORR Equipment has effectively removed the stream pollution menace in many Textile Mills, and the experience gained by our Engineers in handling a variety of wastes is available to assist you with your problem.

Our service includes a thorough investigation of the waste; development of a method of treatment; a layout of the units of Dorr equipment that will assist in the economical solution of the problem, including the complete mechanical equipment required, such as Dorr units, chemical feeding devices, pumps, etc.; and engineering service in connection with the setting up and starting of the plant.

Write for our
"Sanitary Engineering Bulletin"

DORRCO

The Symbol of "Service"

THE DORR COMPANY
ENGINEERS
247 PARK AVENUE NEW YORK CITY

DENVER LOS ANGELES CHICAGO WILKES-BARRE JOPLIN

THE DORR CO. LTD
16 South Street London E.C.2

DORR G. m.b.H.
Joachimsthalerstr 10, Berlin W.15

SOC. DORR ET CIE.
126, Rue de Provence Paris 8

INVESTIGATION TESTS DESIGN EQUIPMENT

AMALIE PRODUCTS

Power of Penetration

The Facts about Amalie Sonolene are well worth Knowing!

What are you looking for in the bleaching and dyeing of cotton yarns and piece goods? Speed? Economy? Quality? All these you get in Amalie Sonolene—a most powerful detergent.

For Amalie Sonolene is *a forceful penetrant* which

—increases the effectiveness of penetration by the alkali, and counteracts its harsh action;

—causes maximum thoroughness and completeness of the Kier boiling;

—readily dissolves and removes the natural fatty and waxy impurities in the cotton, attaining perfect white in bleaching;

—requires only one boil where two were needed;

—in open and closed dyeing machines, eliminates the usual difficulty of ordinary turkey red oils through foaming, being recommended especially for Franklin Dyeing Machines;

—in raw stock dyeing, eliminates static by the addition of from 1½% to 2%.

And all these advantages come back to its essential property—its *power of penetration.* Try our Amalie Sonolene and be convinced!

Leaflet completely describing the properties, function and uses of Amalie Sonolene sent anywhere free upon request.

L. SONNEBORN SONS, Inc.

Manufacturing Chemists for the Textile Industry

114 FIFTH AVENUE NEW YORK

Sales Offices and Warehouses in all Principal Textile Centers

Amalie SONOLENE

L. SONNEBORN SONS, INC., NEW YORK, N.Y.

ANTHRAPOLE OIL

UNEXCELLED FOR WOOL AND WORSTED PIECE DYEING

REMOVES OIL SPOTS AND LIME SOAPS

ELIMINATES THE CAUSE OF STREAKY PIECES, ASSURING LEVEL DYEINGS

ARKANSAS COMPANY

INCORPORATED

233 BROADWAY NEW YORK

ALIZARINES BEAVER SULPHUR COLORS

ECONOMY SERVICE

Sulphur Orange B C O

A recent addition to the line of sulphur colors being manufactured by the Beaver Chemical Corporation. A highly refined superior product yielding a bright clear shade fast to washing, very soluble and eminently suitable for machine dyeing.

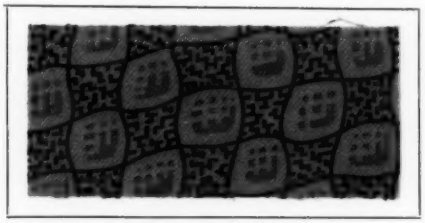
DUNKER & PERKINS CO.

263 SUMMER STREET BOSTON, MASS.

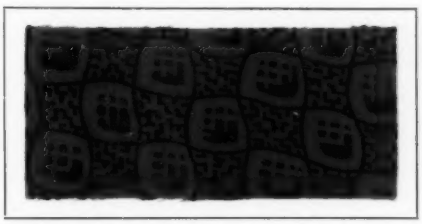
GENERAL DYESTUFF CORPORATION

Indanthren Dyeings Discharged with Indanthren Dyestuffs.

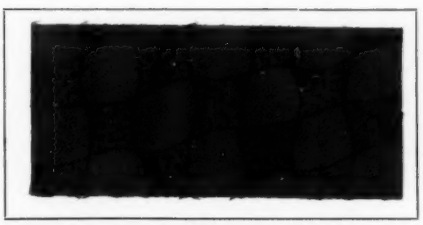
(Patent for this process applied for in numerous countries).



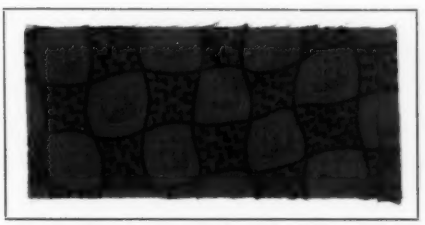
Ground: 15% Indanthren Grey 6B paste
Cover print: Indanthren Orange RRT paste fine
Indanthren Printing Black B paste



Ground: 10% Indanthren Printing Brown R paste
Cover print: Indanthren Brilliant Blue R double paste fine
Indanthren Printing Black B paste

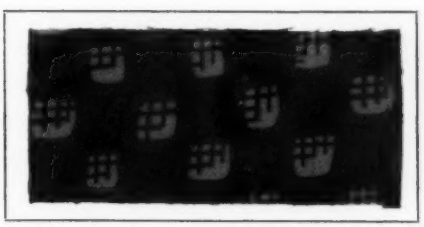


Ground: 1.5% Indanthren Brilliant Violet RR paste
4.5% Indanthren Red Violet RH paste
Cover print: Indanthren Yellow G double paste fine
Indanthren Brilliant Blue 3G paste fine
Indanthren Printing Black B paste



Ground: 4% Indanthren Olive R paste
Cover print: Indanthren Brilliant Pink R paste
Indanthren Printing Black B paste

Ground: 0.65% Indanthren Brown G paste
5.3 % Indanthren Yellow GK paste
6.6 % Indanthren Olive R paste
Cover print: Indanthren Brilliant Blue 3G paste fine
Indanthren Printing Black B paste



Ground: 5% Indanthren Printing Violet BF paste
Cover print: Indanthren Golden Yellow GK double paste
Indanthren Printing Black B paste

Dyestuffs manufactured by

I. G. FARBENINDUSTRIE AKTIENGESELLSCHAFT

Frankfurt a. M., Hoechst a. M., Leverkusen a. Rh., Ludwigshafen a. Rh.

Recipes for the patterns shown on the other side.

Discharge Colors:	Yellow GK	Green G	Orange RRT	Pink R	Blue 3G	Blue R	
Standard Colors:	550	550	550	550	550	550	parts
Indanthren Golden Yellow GK double paste	200	—	—	—	—	—	„
Indanthren Yellow G double paste fine	—	150	—	—	—	—	„
Indanthren Orange RRT paste fine	—	—	200	—	—	—	„
Indanthren Brilliant Pink R paste	—	—	—	300	—	—	„
Indanthren Brilliant Blue 3G paste fine	—	50	—	—	200	—	„
Indanthren Brilliant Blue R double paste fine	—	—	—	—	—	100	„
Leucotrope W conc.	60	100	80	60	80	80	„
Anthraquinone paste	30	30	30	—	30	30	„
Water	160	120	140	90	140	240	„

1000 parts each (by weight)

Black B.

300 parts Indanthren Printing Black B paste
30 „ Glycerin
290 „ Starch Tragacanth thickening
120 „ Potash
60 „ Dissolving Salt B (1:1)
50 „ Hydrosulphite conc. Powder
are heated to 140° F. until the dyestuff is dissolved; when cool,
150 „ Rongalite C (2:1)
are added.

1000 parts (by weight)

Discharge stock paste.

50 parts Zinc Oxide
50 „ Glycerin
30 „ Dissolving Salt B
200 „ Wheat Starch Tragacanth thickening
120 „ Potash
100 „ Rongalite C

After printing the goods with the discharge colors, they are dried, steamed with moist steam for 5 minutes at 215° F. in the Mather-Platt Rapid Ager, well washed, soaped for 10 minutes at the boil and finally rinsed.

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The sticky deposit clinging to these fibres will result in a defective spot. The mill's water supply is directly responsible for such deposits. From an unretouched photomicrograph.

These fibres were processed by the same mill in the same way as the fibres to the left, except that conditioned water was used. Note the clean, smooth surfaces, free from clinging deposits. From an unretouched photomicrograph.

Know your water supply

OF all the raw materials used in your mill, none will better repay your close study and attention than your water supply.

Water is such a commonplace material that its importance is usually overlooked. Yet no single item has a more vital influence for good or evil in your plant operation. Faulty goods, rejections, a dozen manufacturing troubles that you blame on other things are often due to impurities in the water.

Consider the path that water must take before it reaches your mill. After it falls on the earth as rain it soaks into the ground, runs over rocks and minerals, comes into contact with leaves and other decaying vegetable matter, and perhaps runs into rivers, lakes or streams. Finally, it flows through pipes into your mill.

But by then it may no longer be the pure harmless element it seems. It may look all right and be perfectly fit to drink. But water is a great solvent. Before reaching your mill it dissolves and carries along many substances that have no place in textile manufacture. What does this mean?

You use water in many different ways. The physical and chemical balance of many materials employed in your work is easily upset. Is it any wonder that a large percentage of rejections, a great many of your manufacturing troubles, may be traced directly to your water supply?

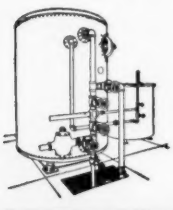
The wonder is that so many textile mills go along for years without suspecting the real cause of their troubles. In everything else—their plant, their equipment and methods, these mills are right up to the minute. But the quality of their water supply they never question. Yet each day thousands of gallons of water flow through their plant, perhaps offsetting the influence of the best dyes and chemicals, the best raw cotton, silk or wool in the world.

Just such a mill sent us the two photomicrographs you see above. The name of this mill you would know at once. For years it went along with about the same troubles, the same unit cost as its competitors. But in its search for methods of cutting costs and improving the quality of its output, this mill finally did question its water supply.

It got in touch with The Permutit Company, largest water conditioning specialists in the world. Upon their advice, water conditioning apparatus was installed to remove the objectionable impurities from the mill's water supply. Since that time this mill has actually saved thousands of dollars. It has reduced its manufacturing cost. It has improved the quality of finished goods. It has cut down the rejections and eliminated many manufacturing troubles.

How about the water supply of your own mill? Are you certain that it contains no harmful impurities? Remember that even when you have analyzed your water and are sure it is all right today, a rain or a drought may change its makeup completely in a short time.

The subject is well worth your further investigation. Our booklet, "Reducing Textile Costs and Troubles," goes into the matter at length. It is an authoritative contribution on the subject of textile mill water supplies. Send for a free copy today, there is no obligation.



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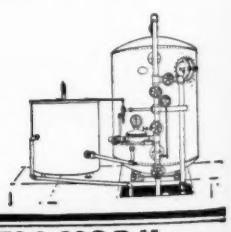

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AMERICAN DYESTUFF REPORTER

SAMPLE SWATCH QUARTERLY

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NEW YORK, OCTOBER 18, 1926

Dyeing of Cotton Warps by the "Chain" Method

The Steps in the Process—The Ball Warper—Boiling Out—Doubling—Applying the Direct Colors—The Basic Colors—The Vat Colors—Stripping—Splitting

By LEON W. SIDEBOTTOM

Textile Colorist, Essex Aniline Works

COTTON yarn to be colored and used in the manufacture of warps for fancy ginghams, flannellettes, cotton blankets, etc., is very conveniently and economically handled in the chain form and the method is commonly designated as "chain dyeing." While this method has been somewhat superseded of late years by various package dyeing machines of the circulating type, chain dyeing still holds a very prominent position in the dyeing of cotton yarn. By this method cotton warps may be dyed with any class of cotton colors with the possible exception of some of the vat colors and those known as the ingrain or insoluble azo colors, including the newer "Naphthols." The chain system is very desirable for dyehouses doing a large variety of colored work, where the amount of yarn dyed to a single shade will necessarily vary anywhere between 100 and 2,000 pounds.

The several steps in the process of chain dyeing are arranged as follows:

1. Ball Warping
2. Boiling out
3. Doubling
4. Bleaching and dyeing.
5. Splitting
6. Drying
7. Peaming.

While the first and last steps do not take place in the dyehouse and are operations over which the dyer has no actual control, still they must be considered as included in the procedure since they are both peculiar to this form of dyeing.

The Ball Warper

The first step, commonly called balling, consists of winding the threads from individual spools onto a single spool or beam after they have been bunched together in the rope or chain form. The machine employed is known as a ball warper such as is illustrated in Fig. 1. The spools are supported in the rear of the machine proper on the creel (A). From the creel the threads are pulled over rolls, through a suitable measuring device, condensed by the guide (B) to the rope form and wound onto the wooden roll (C). The operation is purely mechanical and the completed warp is cut off and removed when the desired length is obtained. Another roll is placed on the revolving rollers (D) and a second warp started. The number of threads or ends, as they are called, depends entirely upon the patterns being woven and may range from 200 to 600 ends. The loom pattern will require from 1 to 4 of these warps for what is known in the dyehouse as a set. The sets must be kept together throughout the dyeing operations if the amount of seconds is to be reduced to a minimum. The possible slight variations in dyeing make this imperative. It is readily seen that if four warps are to be run on the same loom beam for weaving, the operation known as slashing, or dressing, will intermingle them in such a way that they must be all alike or the woven cloth will show streaky. Light ends, stops in the dye liquor, and breakages all increase the amount of seconds, or wastes. When the warps for one loom set are dyed together, the light ends, or stops, will come pretty nearly at the same place in the beam and will not cause the loss of as much woven cloth as though the unevenness was scattered at varying intervals throughout the length of the warp. All breaks must be tied in the beaming rooms. When the break is small it is readily tied and may be woven without trouble. When the break is large, in order to save time, the warp is twisted over, which means that the ends are simply

twisted together. The chafing of the harnesses and reeds in the loom will remove the twist from the broken portion and cause serious trouble by falling in the reeds. To avoid this the warp is pulled through the harnesses and the twistover section is cut out. If these twistovers occur at approximately the same place the waste is naturally reduced.

The length of the ball warps depends not so much on the loom pattern as the system in use at the mill, and will vary from 5,000 to 10,000 yards.

After the balling the warps are conveyed to the dyehouse or storeroom and assembled into sets, which, when completed are ready for boiling out.

Boiling Out

The boiling out is the first operation in the dyehouse proper. This operation may be conveniently accomplished in a two-compartment machine, the first compartment containing the boiling soda ash or caustic soda, the second compartment equipped with an overflow pipe to permit the use of running cold water. Heavy rubber covered squeeze rolls are situated between the two compartments and at the delivery from the cold water wash. The boiling box should deliver between 30 to 40 yards per minute with an immersion of about 10 to 15 yards in the boiling out liquor. It is a good idea to have the guide rolls which are under the water equipped with a hoisting arrangement so that in case of any accident the rolls may be lifted readily. This will save the time and steam consumed in bringing a bath of cold water to a boil again. An open coil for heating is perhaps preferable, as the condensation will help to replace the water removed by the dry yarn. A straw winding attachment placed at the entrance to the boiling box will reduce the amount of yarn breakage considerably.

The average boiling box will accommodate between 24 to 30 warps and of course should be loaded to capacity for economy. It might be well at this time to speak of the size of the sets in respect to poundage. It will work out much more satisfactorily from the dyer's standpoint to have the sets running at nearly the same weight. If we adopt a 1,000-pound set, or thereabouts, as a standard and attempt to keep the following lots at nearly the same weight, the task of matching shades will be lightened noticeably. The volume of dye liquor must remain very nearly the same whether the set weighs 200 or 2,000 pounds, but a formula which will match the shade desired with a 200-pound set will be found, usually, to give decided differences with 2,000 pounds. The larger set will take, as a rule, less dyestuff in proportion than the smaller one, on account of a more complete exhaustion, due to lower ratio of yarn to dye liquor.

After assembling into sets the warps are placed in racks at the rear of the machine, threaded through pot eyes, over pin rails, through the winding attachment, and into the boiling compartment. The necessary amount of caustic soda or soda ash is weighed out and about half the amount put into the boiling box for the start, the remainder being fed in from time to time as the "run" progresses. The cold wash will remove the excess of alkali and also set the yarn somewhat, so that when delivered it will not be as likely to curl and kink.

The boiling box is the dividing line between the long chain dyeing proper and the doubled form of long chain dyeing. The doubled form will be considered from now on. The boiling process may also be regarded as a preliminary doubling process, as the warps to be dyed the same color are bunched together at the delivery rolls and are run into one container.

Since the operation is quite rapid and the amount of yarn immersed at any one time is necessarily small, care must be used to insure a good boil, particularly for those sets which are to be bleached. The doubling operation follows the boiling out and must be prepared for as the yarn is being delivered from the squeeze rolls. For a simple illustration we will say the warp is 10,000 yards long and we wish to double this down to 2,500 yards for manipulation in the dye kettle. The warps have been bunched together and are running into one

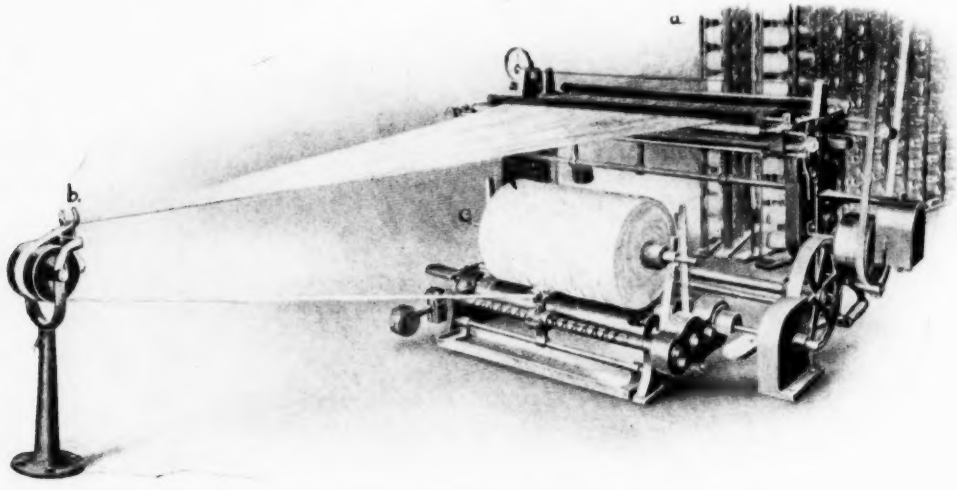

Fig. 1.

container. When 2,500 yards of yarn have been run into the first container it is replaced by an empty one and 2,500 yards allowed to run into this second container. This operation is reported with a third and fourth truck. At the completion of the boiling we will then have one long chain consisting of from 2 to 8 individual warps piled in four lots with equal yardage in each container. The yarn is now ready for the doubling.

Doubling

Doubling is primarily a time saver. The time consumed in the dye kettles with the long warps would be prohibitive with the majority of colors. In order to overcome this loss of time a warp is worked which is four times as heavy per running yard but only one-quarter the length. At the doubling machine, continuing our previous illustration, we will take the first and last ends of the warp and bunch them together with the center and run this doubled end over suitable rolls for tension and into a single truck. The second and last of the boxes must, of course, be dumped to avoid the yarn pulling from the bottom. Equal tension must be applied to all four strands or the resulting tight or loose warps will cause disasterous results in the ensuing operations. Bunches or loops will form which are quite apt to ride over the flanges and guides in the dye kettles, causing "windups." If this trouble happens to be avoided, the hard bunches which form will either remain undyed or will stick at the squeeze rolls and cause chafing or "burning." The yarn is now in a condition for the dyeing proper.

The dyeing of doubled warps is carried out in the familiar Scotch Tub, illustrated by Fig. 2, which shows a cross section with warp threaded through; Fig. 3, which shows a more recent type with inner rolls exhibited separately, and Fig. 4 a similar machine of different make. A square kettle of like capacity and similar construction may also be used. The method of handling the warps will vary with different machines, but the principle is essentially the same. With the Scotch Tub the yarn enters at one side of the tub, circulates a short period in the liquor and emerges through squeeze rolls at the opposite side. Two workmen are required for the manipulation of the yarn. One man will attend to feeding the color and watching the yarn as it enters the guide eye to see that no snarls or lumps are allowed to enter the kettle. The second man is at the delivery to carry on the plaiting down.

These tubs should be regulated to deliver between 30 to 35 yards per minute. On some of the square kettles the yarn is conveyed from the front to the rear of the tub overhead before immersion and delivered at the front again. This permits the operator to keep closer watch for imperfect work, but has the disadvantage of putting a greater strain on the yarn.

For the production of light and bright shades, and for white striped cloth, the warps must be bleached. The colored work will not need a full bleach and may be readily accomplished in a square tub with two compartments which in reality gives the effect of two runs for the time necessary to complete one. Each compartment has about the same liquid capacity as the Scotch Tub, and also has two sets of squeeze rolls. A full bleach for white work must be given a more thorough bleaching. A very convenient method is to fold the material into a large kettle capable of holding the entire set. This kettle or tub is filled with hypochlorite solution, either calcium or sodium, at the proper strength and after plaiting down, the warps are allowed to remain in the liquor, completely immersed, for one to two hours, depending on the strength of the bleaching liquor. After bleaching by either method the yarn should then be given a running wash with cold water to remove the excess of hypochlorite. A very convenient method of finishing the bleaching operation is the bisulphite method. Instead of souring with acids and subsequent washing, it is possible to give a run with bisulphite of soda, which will "kill" the chlorine left in the yarn, followed by a run through boiling water. It might be well to mention at this time that a "run" is the term applied to one passage of the warp through the liquor.

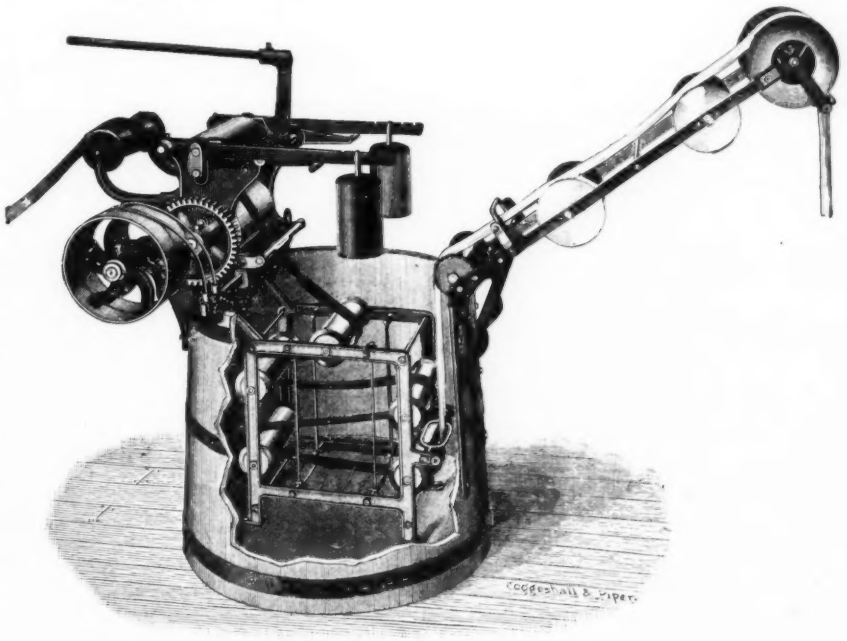

Fig. 2

Standing kettles are seldom used with the exception of blacks and reds and for some of the sulphur colors. The proportion of dye liquor to material is small and the percentage of dyestuff remaining is negligible except with the heavier colors mentioned.

Applying the Direct Colors

The direct colors are the easiest to apply. The necessary amount of dyestuff is dissolved in a tub or barrel, the usual precautions being taken as regards hard water, and pasting the dyestuff before the addition of the boiling water. Condensed steam, if free from oil, is to be recommended. The amount of water used for dissolving the color is regulated to a great extent on the solubility, the amount of dyestuff to be used, and the number of runs to be made. Such colors as browns, reds and blacks will require the most. The ordinary 50-gallon barrel will usually hold sufficient water for sets up to 1,500 pounds. Light dyeings for the cheaper grades of flannels and ginghams may be accomplished in two runs. For the better grades of work this number should be increased to four to insure penetration and evenness. The heavier shades and also tans and browns will require at least six runs. If possible, colors which exhaust to the same degree or as nearly so as possible, should be selected, or with the gradual building up or exhaustion of one or more colors it will be almost impossible to obtain even ends. Taking a brown, for example, the dyestuff is dissolved in a barrel with about 40 gallons of water. This stock liquor must be distributed over the six runs in such a way that all parts of the warp are dyed to the same depth. To accomplish this the water in the kettle is brought to a boil and stuffed or set with about three gallons of the stock liquor and a proportionate amount of common salt, soda, soap, or other dyeing assistant. A small tub fitted with a faucet is placed conveniently at the side of the tub and a steady stream of stock liquor allowed to flow in during the entire run. This stream should be regulated to consume about 6 to 7 gallons of the stock liquor. The tub must be covered with muslin or some sort of strainer to catch any insoluble particles

Fig. 3

of dyestuff or foreign matter. The stock liquor remaining is "fed on" in the same way for the runs to follow, except that the amount of dye used in stuffing is cut down to one-third or one-quarter of the original amount. The temperature, usually a boil, must be kept constant throughout. The warp is examined end for end and also with the center to determine if it has light ends or a light center. If the set is even throughout it is compared with the standard shade, and if satisfactory is washed and softened. It is then ready for the converting operations. Should there be a light end, correction must take place at once by means of another run, the light end being run into the liquor which has been stuffed to a certain degree, and feeding on discontinued. Corrections of shade to standard are made either in one or two runs, depending upon the amount of dye to be added. Direct colors, capable or being diazotized and developed, are rinsed after the dyeing to remove the color loosely held on the fiber and cool the yarn to prevent decomposition of the diazo compound. Diazotization is accomplished in two cold runs. The stock liquors of $NaNO_2$ and HCl or H_2SO_4 are fed in from two separate tubs so that they will thoroughly mix in the bath. It is sometimes necessary to use ice in the bath during the warm weather. The diazotized warp is given a running cold wash without necessary delay and is ready for developing. Two runs will be found sufficient with the precaution that there is an excess of developer present. A rinse and thorough soaping follows.

After treatment with metallic salts or formaldehyde is usually completed in two runs at 140 to 150 deg. followed by rinsing and softening.

The Basic Colors

Basic colors are handled practically the same way. The mordanting with tannin or sumac being carried out in two runs for light shades and four runs for heavier shades at 160 deg. Fahr. to a boil. The tannin is fixed with antimony salts or tartar emetic in two cold runs without intermediate washing. The basic color is dissolved with the aid of acetic acid and made up into a stock liquor the same as with the direct colors. The dye is fed on at the required temperature, usually between 120 to 160 deg. Fahr. in four runs for light shades and six to eight runs for heavy shades. The number of runs is increased with basic colors since their tendency is to dye unevenly and they must be fed on slowly to prevent the color exhausting itself on the outside of the fiber. After dyeing the yarn is washed and softened.

The ice colors, or those requiring padding and subsequent coupling, are not quite as practical on doubled warps although some of these may be applied in the long chain form on continuous machines or very light-weight doubled warps. If we attempted to pad a heavy warp, the yarn lying in the bottom of the container will hold a large excess of the padding liquor due to the draining of the upper portions of the box. When developed this portion will be deeper in shade and will also have a decided tendency to crock. Another item is the fact that the squeeze on heavy warps is not perfect, the selvedges containing more of the liquor than the middle portions.

When dyeing sulphur colors the fixtures of the machine, that is the guides, rolls, frame, etc., are made of

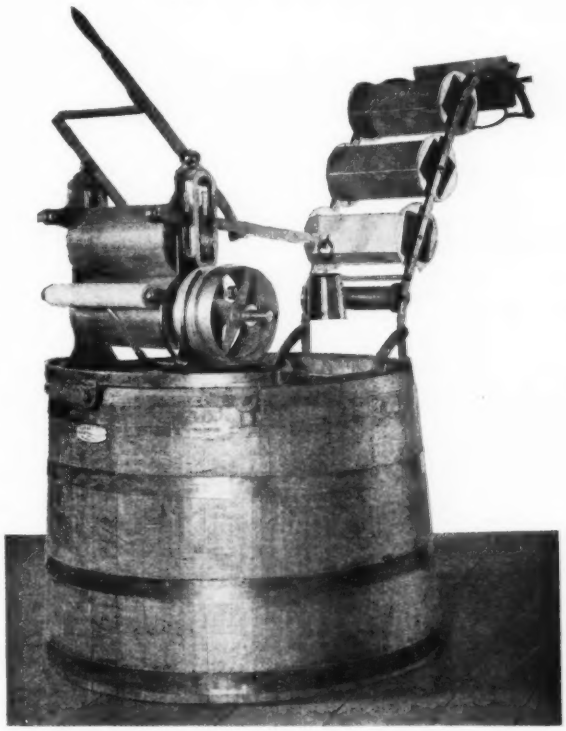

Fig. 4

iron rather than the usual brass. The dyeing is carried out the same as in previous cases, the feeding liquor being a solution of the dyestuff in sodium sulphide and soda ash. With sulphur colors, however, it is not necessary to use a steady stream when feeding on. It will be found that since this class of colors exhaust more slowly, evenness may be obtained equally well by adding a dipper full of stock liquor now and then. The salt is added directly to the boiling liquor in the kettle. Shades composed of a single dyestuff, as dark blues and blacks, may be economically worked in standing baths. Aftertreatment with metallic salts, oxidizing, soaping and rinsing are accomplished in two runs. A thorough washing before the final softening is essential to remove all traces of sulphide and alkali.

The Vat Colors

The application of the so-called vat colors will present a greater number of difficulties. Indigo and its derivatives as a whole are best applied from standing baths in the long chain form rather than the doubled form. The light shades of these dyestuffs, however, are sometimes

dyed doubled. Those vats belonging to the Hydron class are applied to warps in the double condition quite readily. The vats which are derivatives of anthraquinone will be found to vary in regards to application. A great many of the blues level readily and do not exhaust too quickly, such as the Blue GCD. On the other hand the Violet 2R exhausts quickly and does not level at all easily. Combinations of these colors must be chosen very carefully in regards to their exhaustion and level dyeing properties. Nevertheless, with proper care it is possible to dye sets not too large or bulky with combinations for greens, browns, tans, etc. The kettle for dyeing these colors should be slightly different from the ordinary yarn tub to permit a longer immersion. A 25 to 30 yard dip should be enough. Since this class of vats oxidizes quickly, it is not necessary to have the large skying arrangement usually met with in connection with Indigo and its derivatives. The sets as a rule are not run as heavy, permitting a more even dip at the squeeze rolls. If it has been necessary to bleach, great care must be taken to have all the lime salts removed from the yarn before dyeing, as these salts will dull and weaken the resulting shade. The vats should be applied with a minimum of four runs. The operation may be outlined as follows: The necessary amount of color, either paste or powder, is made into a stock solution of not less than fifty gallons. If a powder, it is pasted with a little alcohol or soluble oil, previous to reducing and dissolving. The required amount of caustic in powder or flake form is added and the temperature raised to the point at which the color is to be reduced. The reducing temperature will vary, depending upon the particular dyestuff used. The hydro is then added slowly, stirring continually. After the hydrosulphite is added, the liquor is allowed to stand one-half to three-quarters of an hour to insure complete reduction. The water of the dye bath is brought to the desired temperature and is corrected with a few ounces of caustic and hydro, and set with three or four gallons of the stock liquor for the first run. Enough of the stock solution is fed throughout the run to insure both ends of the set being dyed to the same depth. The second run is a repetition of the first, and so on. Rinsing, oxidizing, or brightening and soaping follow.

Stripping

Overdyed, off shade and very uneven sets must be lightened or stripped. Oftentimes when overdyed a run or two in boiling water, with or without the addition of soap or soda, will lighten the shade so that it may be rematched. If too heavy, or very much off shade, we must resort to calcium or sodium hypochlorite or the hydrosulphite compounds. Hypochlorite is usually the "fix all" in the ordinary cotton yarn dyehouse using the substantive colors. Of course, when using Fast Yellow B, Stilbene Yellows, Primuline or Primiline base colors, etc., the stripped yarn will be yellow, which must be taken as a base when rematching. Sulphur colors may be stripped to a sufficient degree with a weak sodium sulphide solution. Hypochlorites will destroy this class of colors completely. Vat colors as a rule will be found difficult to strip, hypochlorites not being effective. A number of runs in a solution of caustic soda and sodium hydrosulphite at about 120 deg. Fahr. will sometimes weaken the shade to a degree which will permit rematching.

Transferring of laboratory formulas to the dyehouse is difficult. With raw cotton and skeins the dyehouse will very nearly follow the laboratory, but with chain dyeing the proportion of dye liquor to yarn being so small (practically 1 to 1), and the time of immersion being of such short duration, it is almost impossible to develop a working formula with any great degree of accuracy, especially if dyestuffs have been compounded. The easiest and most accurate method of transferring laboratory

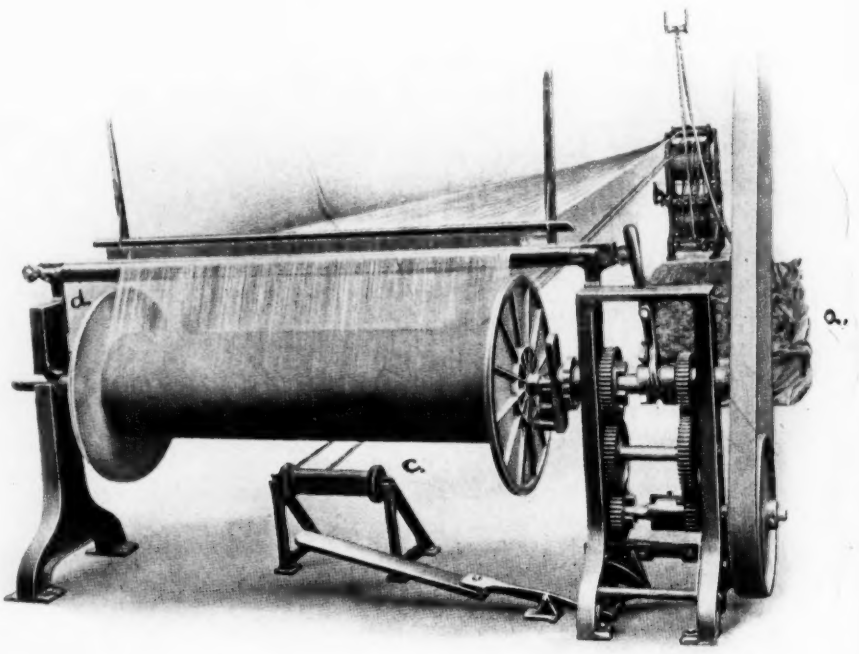

Fig. 5

matches is to dissolve each dyestuff separately and feed proportional parts for each run. It is simpler to control the shade in this manner than by dissolving dyestuffs in one container and feeding the mixture as a whole.

The chief points to emphasize in dyeing all classes of dyestuffs by this method are perhaps, first, the necessity of feeding color throughout the run to maintain an even depth of shade; second, even temperature throughout the length of the run, and third, a good even nip at the squeeze rolls.

Splitting

The process of splitting is the reverse of the doubling process. Before being dried the warp must be converted into its long form again. This means that the four ends which were doubled into one bundle must be split or separated into four sections. Like doubling, this operation is purely mechanical. After the warps have been reconverted to the form in which it was received from the boiling box the dyer has a choice on the final splitting. What has really happened in the boiling box, as has been stated before, may be considered the first doubling, as the warps going to make up the set, whether four, eight or ten, were bunched together into one heavy warp. The dyer may do the reverse of this operation on the splitter or at the dry cans as the warps must be separated into their original single form before beaming. Much may be said in favor of both methods. If done on the splitter the time consumed is greater, of course; if done on the dryer the time consumed is shorter, but some will say the danger of breakage is greatly increased. The dyer must be governed by the grade of work being handled and the production demanded from the dyehouse.

The drying of the warps is done in the ordinary upright dry cans of 16 to 20 cans. The yarn enters at one end of the dryer and travels spirally around the cans and is discharged by means of a folder into a truck, box or bundle, or other handy form for the beaming room. Too high a steam pressure must be avoided as some colors are quite sensitive in this respect. Care must also be exercised at this point that light shades are not run directly after heavy shades, as the cans are bound to be stained somewhat.

Beaming is the last step, and like balling does not come under the supervision of the dyehouse, but is, nevertheless, of vital interest to the dyer, as at this stage the yarn receives its final inspection. Heavy ends, or centers, or otherwise uneven dyeing, is readily detected and if too serious must be rejected and returned to the dyehouse for redyeing, or other methods of leveling. Broken ends, chafed yarn, and other defects are also detected at this point and the dyehouse notified so that any defect in machinery may be discovered and corrected. The beaming is done on a machine as illustrated in Fig. 5. The yarn from the dyehouse is received in the bundle (a). The warp is threaded through the tension apparatus (b) which applies enough tension to keep the yarn taut, thence to the floor stand (c) which allows the yarn to open a certain amount and relieve the twist. From the top of the tension end to the slasher beam (d) the yarn is spread out to the sheet form and wound ready for further conversion at the slasher. On certain classes of work the yarn may be beamed directly onto the loom beams.

Success or failure of the various operations depends entirely upon the condition in which the yarn is delivered to the beaming room. Harsh or lifeless yarn, due to overbleaching or overhandling, and broken or chafed yarn, all contribute towards excessive cost in beaming. Expert care and judgment must be exercised at all times.

A Discussion on Naphthol AS in Printing and Dyeing

Imitation of Turkey Red-Indigo Styles—Dyeing Yarn and Loose Cotton—Obtaining Red-White Effect

By DR. W. KIELBASINSKI

(Translated from Melliand's Textil-Berichte by Carl Toepler)

ALTHOUGH it is a difficult problem to say anything new on the Naphthol AS series and their application, as there is considerable literature on the subject, the author ventures this communication, as in a certain degree he was a witness to the development of the original idea that has led to the present series of Naphthol AS colors.

At the time Fischesser and Porkony described their beta-oxynaphthoic (m. p. 216) in the Bul. de la Soc. Mulhouse in 1901 for the preparation of ice blue on the fiber, it was not thought that this combination would lead to a much greater practical application. At that time it was impossible to imitate the well-known Schlieper & Baum Turkey Red-Indigo prints, as the red produced was quite poor.

This problem was solved by the author's co-worker, the late K. Bukowiecki, at the print works of N. M. Paluschin at Iwanow, through the addition of barium chloride to the diazotized para-nitraniline. He started out with the idea that the COOH group must be com-

bined, and in barium chloride he found the most suitable substance. The red, however, was not quite as good as that on beta-naphthol prepare, but the blue on beta-oxynaphthoic acid was particularly finer, so that the blue-red articles could be printed in large quantities.

Some years later Griesheim combined the COOH group through the condensation with aromatic amino bases. Griesheim then introduced two condensation products of the Porkony acid to the trade: with aniline—under the name of Naphthol AS—and with meta-nitraniline—as Naphthol NA (now called Naphthol AS-BS). These products with diazotized Azo Orange NA produced a splendid red and in strengths of ½ gram of the diazo compound per liter produced brilliant pink shades. These naphthols created considerable interest among colorists, inasmuch as the colors possessed a fastness to light, chlorine and washing not approached by other colors. The author at that time worked out a red-pink style for the Asiatic and Russian trade, imitating the well-known alizarine styles.

By discharging the Griesheim red and pink with Rongalite, one could obtain brilliant styles heretofore unobtainable.

The Schlieper & Baum Turkey Red-Indigo styles could easily be imitated.

As reserves under sulphur, indanthrene and other vat dyes, the Griesheim red produced results previously unobtainable.

After the war, Griesheim produced a whole series of condensation products from beta-oxynaphthoic acid with various amino bases, and proposed a number of new bases for the coupling, thereby making it possible to produce a large number of valuable dyestuffs on the fiber.

The fastness to light of the following combinations, with the designation 5 (excellent), is well known:

Naphthol	AS-RL	Fast Scarlet GG Base
"	"	Fast Red 3GL Base
"	"	Fast Red GL Base
"	"	Fast Red RL Base
"	"	Fast Red B Base
"	"	Fast Red GG Base
"	AS	Fast Red 3GL Base

The blue is considerably less fast to light, but is improved in this respect by an aftertreatment with copper.

The rather simple development of reds from nitrosamines and Naphthol AS has led to the development and application of the so-called rapid fast colors.

The composition of the rapid fast colors is:

Rapid Fast Red B—A mixture of the nitrosamine of diazotized 5-nitro-2-aminoanisole (Fast Red B Base) and Naphthol AS.

Rapid Fast Red BB—A mixture of the nitrosamine of diazotized 5-nitro-2-aminoanisole (Fast Red B Base) and Naphthol AS-BS.

Rapid Fast Red 3GL—A mixture of the nitrosamine of diazotized o-nitro-p-chloraniline and Naphthol AS.

Rapid Fast Red GL—A mixture of the nitrosamine of diazotized 3-nitro-4-aminotoluene and Naphthol AS.

Rapid Fast Red GZ—A mixture of the nitrosamine of diazotized 2:5-dichloraniline and Naphthol AS.

Rapid Fast Orange RG—A mixture of the nitrosamine of diazotized o-nitraniline and Naphthol AS.

Rapid Fast Blue—A mixture of the nitrosamine of tetrazotized dianisidine and Naphthol AS.

The Naphthol AS series finds considerable employment in the dyeing of yarn, and especially loose cotton. A number of fast shades that resist an energetic chloring can be obtained, and these are suitable for colored yarn fabrics that must be subsequently bleached.

The dyeing of Griesheim Red on yarn is comparatively easier to carry out than on loose cotton. If it is necessary to obtain evenness it becomes necessary to dye the loose cotton. The fiber is impregnated with alkaline Naphthol AS solution, and after extracting, coupling with the corresponding diazo solution. The naphthol solution, the process of preparing, and especially the water and the additions of castor-oil soap and formaldehyde, must be carefully watched. In yarn dyeing, an addition of Turkey Red oil is an advantage; when dyeing loose cotton, it must be used with care, as the dyed material does not spin well if the preparation contains too much oil.

The addition of formaldehyde to the naphthols, thereby increasing the stability of the prepare, is disastrous in the case of certain naphthols, if an insufficient amount of Turkey Red oil is added. Naphthol AS-BS, for example, will separate out on cooling after a time, and an addition of caustic soda or heating of the solution will not remedy the trouble. The water must be soft; condensed water or water corrected by an addition of soda is best. Naphthol AS-SW combined with Fast Red KB Base is best suited for the dyeing of loose cotton. To obtain good fastness to rubbing, the cotton after preparing must be well extracted and, after coupling, washed cold and then hot with an addition of some caustic soda.* It must not be forgotten that the Naphthol AS series couples comparatively slower with the diazo compounds than beta-naphthol.

To obtain complete development of the shade, the goods should not be rinsed immediately following the

*Recently Griesheim has recommended an alkaline salt rinse after preparing with Naphthol AS-SW.

coupling, but should be allowed to lie for a few minutes, as is done when dyeing Chrysoidine Brown. In order to obtain level dyeings—for example, with Naphthol AS-SW—the liquor is circulated through the dry, loose cotton in an Obermaier or Psarski apparatus for thirty minutes at 85 to 90 deg. Cent. In this manner a uniform wetting-out and impregration takes place in one operation. In this case the addition of formaldehyde must be omitted, and an addition of 10 to 15 grams glucose, and in order to obtain a cotton of good spinning quality not more than 5 grams of Turkey Red oil per liter added. After dyeing, the goods are well rinsed cold and hot, and to the last rinse is added ½ to 1 gram Glauber salt per liter.

In concluding, the author describes an interesting application of Griesheim Red in the production of red flags. In this case it was necessary to employ those red combinations possessing the greatest fastness to light.

To produce a red-white effect, the goods are printed on a duplex machine with a thickened paste containing 10 to 20 grams Naphthol AS dissolved in caustic soda per kilogram of paste, with an addition of 20 to 30 grams Turkey Red oil, dried, and passed through the corresponding diazo solution, given an airing, washed, soured, rinsed, passed through a 1 per cent hot soda solution, strongly soaped, chlored and finally dried on cans. In this manner a perfect red and white were obtained.

During the Bolshevistic revolution in Russia the author was obliged to hoist a red flag from the chimney of the factory dyed with Paranitraniline Red. In a short time the flag became white. Had the Griesheim Red been available at that time, the author would have been saved from the suspicion of being of a counter-revolutionary mind and from the unpleasant results that followed.

The Chemical Reactions of Keratin and Its Congeners

The Actions of Various Chemicals, Reagents, Etc., on the Keratins as a Class

Part II

By CHAS. E. MULLIN, M.Sc., F.A.I.C.
(*Consulting Chemist, Camden, N. J.*)

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Salts

LLOYD, "Chemistry of the Proteins" (1926), states that the chemical, or physico-chemical, action by which neutral salts increase the solubility of the proteins in water has not yet been satisfactorily explained. While she states that definite crystalline compounds of the amino acids with neutral salts are known, she is not inclined to believe that compounds of these salts with the proteins have been proven. However, their presence influences the combination of the proteins with acids and alkalies.

Lloyd, *loc. cit.*, page 191, points out the fact that dilute solutions of the neutral salts of the alkalies or alkaline earths, say less than two or three normal, increase the solubility of the proteins in water. However, the salts are much less powerful protein solvents than are either acids or alkalies, the two latter being from 200 to 500 times more powerful in this respect than the salts.

Hardy, *J. Physiol. 33,* 251 (1905), in connection with the globulins, showed that the mechanism of solution of the proteins by salts is entirely different from solution by acids or alkalies, in that the protein dissolved by the salt is electrically neutral. He also showed that the amount of salt required to give a transparent solution with the globulin depended upon the amount of globulin present. He gives Table XVII showing the comparative solvent powers of a number of salts. The figures express the weight of dry globulin held in solution by one gram-equivalent of each salt, the value for sodium chloride being taken as unity. He found that the solvent action of salts when in pairs is equal to the sum of the action of each separately. With the last three salts given in the table, the change in the hydrogen ion concentration of the solution may alter the results. Apparently, from Hardy's work, one gram-molecule of sodium chloride can dissolve about 100 grams of globulin under certain conditions.

Loeb, *J. Gen. Physiol. 1,* 39 and 237 (1918-9); *Science 52,* 449 (1920); *J. chim. phys. 18,* 283 (1920); and "Proteins and the Theory of Colloidal Behavior," Chapter No. II, has shown that in the presence of acids or alkalies, the protein reacts with any other salt present in the system. The precise nature of the interaction is decided by the reaction of the solution in relation to the isoelectric point of the protein. On the alkaline side of

TABLE XVII

Solubility of Globulin in Salt Solutions.

Sodium or potassium chloride	1.0
Potassium bromide	1.4
Sodium bromide	1.5
Potassium, sodium, or ammonium nitrate	1.5
Calcium or magnesium nitrate	1.8
Barium, calcium, or magnesium chloride	1.8
Potassium, sodium, or ammonium sulphate	2.0
Magnesium sulphate	1.9
Potassium oxalate	2.1
Magnesium citrate	2.4
Sodium citrate	2.3

the isoelectric point, the protein acts as an acid and combines with the base of the added salt while on the acid side of the isoelectric point it combines with the acid radicle of the salt.

Csapo, *Biochem. Z. 159,* 53 (1925), gives the data in Table XVIII showing the effeit of salts upon the combination of 0.01 *N* hydrochloric acid with 0.9 per cent gelatin in the presence of sodium salts in a concentration of about 0.33 *N*. Gerngross and Lowe, *Collegium,* No. 628, 229 (1922), found that the amount of alkali fixed by hide powder was increased by the addition of neutral salts.

TABLE XVIII

Effect of Salts on the Fixation of Hydrochloric Acid by Gelatin

Anion	Initial pH Without Gelatin	Final pH With Gelatin	H^+ bound
....	1.98	2.30	5.42×10^{-3}
CL	1.98	2.39	6.33×10^{-3}
I	2.00	2.45	6.47×10^{-3}
NO_3	1.96	2.34	6.21×10^{-3}
SO_4	2.01	2.12	2.11×10^{-3}

Barrit, *loc. cit.*, states that keratin substances are converted in to digestible albumoses and peptoses containing sulphur by treatment with dilute mineral salt solutions at moderate temperatures. The reaction is complete and albumoses and peptoses are isolated, when a diluted sample, after treatment with phosphotungstic acid or other reagent for albumoses, gives a filtrate containing but little amino acid.

Sulphides

The action of the sulphides on keratin and particularly wool, is of very great interest in connection with wool pulling, which will be considered more in detail in a later paper. However, the action of the sulphides upon the keratins in general will be considered here in order to keep all of these reactions together. Also see the action of sulphides on wool and hair in the wool reactions which follow.

Merrill, *Ind. and Eng. Chem. 17,* 36 (1925), believes that there is a reaction between keratin and the mercapto (SH) ion which so alters the structure of the protein that the residues are more readily attacked by the hydroxyl ion.

P. Pulewka, *Z. physiol. Chem. 146,* 130-42 (1925), states that the solution of horn substance in alkaline sulphide solutions is inaugurated by a process of swelling. The mercapto (SH) ions formed in the aqueous solution exceed in intensity the swelling effect of the hydroxyl (OH) ions and are responsible for the solvent action on horn. The effect is observed only in alkaline solution.

Bergmann and Stather, *Collegium* (1925), pages 109-10, report on the decomposition of cystine in wool and hair by sodium sulphide and found that the cystine of horse hair is decomposed to a much greater extent than that of wool by this reagent.

H. Menschel, *Arch. exptl. Path. Pharm. 110,* 1-45 (1925), reports that hydrosulphide solutions have a very strong swelling effect upon human nails (keratin), which probably consist largely of the Protein A of Trotman, Trotman and Sutton.* After the maximum swelling effect has been attained, a slow peptization occurs. Aqueous suspensions of arsenous sulphide (orpiment) and hepar (rather indefinite but may mean a sulphide of antimony, calcium or potassium) cause no material change within forty-eight hours.

Lloyd, "Chemistry of the Proteins" (1926), says that the keratins are remarkable for the rapidity with which they are attacked by the sulphides of the alkalies and alkaline earths, but states that the reaction which takes place is not fully understood. She believes, with Merrill, that some interaction occurs in the case of hair between the sulphide present in the hair and the divalent ions of the solution. "The dissolving of keratins in sulphide solutions seems to be a solution rather than a hydrolysis."

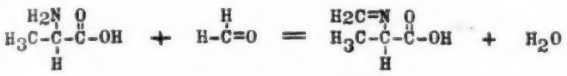
Aldehydes

The reactions of the aldehydes, and particularly formaldehyde, with the proteins are well known and is used in the leather and tanning industry. Formaldehyde also unites with the keratins and their congeners, and the reaction has been proposed as a means of protecting the wool fiber from injury in various processes, but this phase of the matter will be discussed separately later. Bogue, "Chemistry and Technology of Gelatin and Glue," page 570, says that on adding formaldehyde to a gelatine solution a change takes place which to a certain degree is dependent upon the amount of formaldehyde added. When sufficient is added the gelatin sets to a jelly which cannot again be brought into solution by water or heating, either alone or in combination.

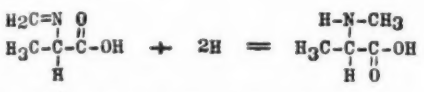
This gelatin-formaldehyde compound is a condensation product, and Mathew's "Physiological Chemistry,"

*See American Dyestuff Reporter 15, 470-1 (1926).

page 121, states that it is formed according to the equation:



Alanine Formaldehyde Methylene Alanine.



Methylene Alanine Methyl Alanine.

By the first equation the methylene substitution products are formed, and these (in the second equation) by reduction from the methyl-amino derivatives. This substitution of methylene for the positive hydrogen of the amino group reduces the basicity of the amino group so that the acid character of the carboxyl group becomes more prominent in the reactions. This increase in the acidic properties of the amino acid is sufficient to allow them to be titrated with sodium hydroxide solution, using phenolphthalein as indicator. The other aldehydes do not react as readily as formaldehyde with the amino acids and proteins.

Lumiere and Seyewetz, *Bull. soc. chim. 35*, 872 (1906), found that on treating dry gelatin with a 10 per cent solution of formaldehyde, it combined chemically with 4 to 4.8 per cent of formaldehyde. This product, known as formo-gelatin, was decomposed of cold 15 per cent hydrochloric acid; by treatment with boiling water; or by heating to 110 deg. Cent. Bogue, *Chem. Met. Eng. 23*, 7-9 (1920), also investigated the compounds.

Bergmann, *Collegium* (1923), 132, believes that formaldehyde can combine with the peptide groups, as well as with the amino groups. For instance, diketopiperazine combines with formaldehyde in the molecular ratio of 1 to 2. He also found that glycocoll acetic ester forms a stable compound with formaldehyde in a molecular ratio of 1 to 3.

According to Thomas, Kelly and Foster, J. Amer. *Leather Chem. Assoc. 21*, 57-76 (1926), experiments with powdered gelatin or hide powder and formaldehyde solutions show that the tanning action is best between pH 6.0 and 9.0. The amount of formaldehyde fixed from increasingly concentrated solutions increases but not in direct proportion. High concentrations of sodium chloride increase the rate of fixation. Neutral or faintly alkaline solutions of formaldehyde are most favorable for tanning.

From the results of experiments on the treatment of pelt with different aldehydes, ketones, diketones, ethyl acetoacetate, phenolphthalein, eosin, and methyl, Powarnin, *Collegium* (1924), 153-8, believes that all aldehydes have a tanning action on the proteins, particularly those in which there are present factors capable of affecting the mobility of the carbonyl oxygen, for instance, double linkage, benzene nucleus, hydroxyl groups, etc. The fewer the carbon atoms in the molecule, the weaker is the tanning action of aliphatic aldehydes. Aqueous solutions of tanning materials containing carboxyl groups appear to have more action on the proteins than alcoholic solutions, and this last fact favors the chemical theory of the carbonyl tannage. The possibility of tanning with liquid products, such as citronellal, acetaldehyde, and benzaldehyde, is opposed to the theory of peptization. Extraordinarily soft leather is obtained with furfural, ethyl acetoacetate, and cinnamyl aldehyde, the softness remaining even after the odor has disappeared. I would be interesting to study the protective action of some of these substances on wool.

Halogens

The action of chlorine upon the keratins is of particular importance in connection with the non-shrinkable process for wool, wool printing, etc. The action of bromine, iodine, and fluorine on the keratins is not at present of any great interest in relation to wool. Meunier, *Compt. Rend. Acad. Sc. 146*, 987 (1908), found that chlorine and bromine precipitate gelatin from solution, and that the precipitates gradually become insoluble in water, acids or alkalies. Iodine does not have this effect. Some keratins, probably horn, do not change much in external appearance on treating with chlorine water or bromine water, but after drying are harsh to the the touch and dissolve in ammonia with the evolution of nitrogen.

It is important to note that chlorine unites wtih the amino group to form chloramines, which were discussed in the paper on "Protein Compounds—I," in connection with the work of Trotman and Wyche.* The chloramines are not decomposed by acidified hydrogen peroxide and in this way T. and W. were able to show that chlorine combines with deaminated proteins to almost the same extent as with the normal protein.

Blasel and Matula, *Biochem. Z. 58*, 417 (1914), also found that chlorine was fixed by deaminized gelatin, in spite of the absence of terminal amino groups.

At a recent meeting of the Biochemical Society, *J. Soc. Chem. Ind. 45*, 110-1 (1926), N. Wright, in discussing the action of hypochlorites on amino acids and proteins, stated that if small quantities of protein are added to hypochlorite solutions the hypochlorite is rapidly decomposed but with larger quantities of protein *less* decomposition occurs, while with still larger quantities of protein, there is again increased decomposition up to a point where there is no longer any "avalable chlorine" present in the solution. Experiments with the amino acids indicates that these may be divided into three classes according to their action on hypochlorite solutions: (1) Those which cause complete destruction of the hypochlorite, as for instance, cystine. (2) Those in which small quantities cause complete destruction of their hypochlorite, but which in larger quantities are themselves chlorinated, and ultimately, if present in sufficiently large quantities, cause

*American Dyestuff Reporter 15, 537-8 (1926).

no reduction in the initial "available chlorine." Glycine belongs to this group. (3) Miscellaneous amino acids which appear to react partly by oxidation and partly by chlorination, the curve of hypochlorite destruction falling in a straight line to a nearly constant level. By taking a mixture, say 10 parts of glycine with 1 part of cystine, and following the effect of this mixture on solutions of hypochlorite, results which are analogous with those of the proteins are obtained. W. concludes that the action of hypochlorites upon the proteins appears to be a resultant of (*a*) complete oxidation of small quantities of protein, (*b*) chlorination if larger quantities of protein are present, due to the glycine content, and (*c*) further gradual oxidation with still larger quantities of protein, due to the action of some constituent, probably cystine, which is an active reducing agent, but which is only present in small amounts.

It has been shown by many workers that chlorine has a very considerable action on wool-keratin, and Barritt, *J. Textile Institute 17*, 111-26T (1926) states that as much as 30 per cent of wool-keratin may be destroyed by excessive chlorination. Also see the action of chlorine on wool in a later paper.

Phenols

There are several analogies between diketopiperazine and collagen which are interesting in connection with wool which probably contains some diketopiperazine groups. Powarnin and Tichomirow, *Collegium* (1924), 158-61, found that diketopiperazine forms compounds with phenolic substances very rapidly. Molecular proportions of phenols, such as pyrocatecol, resorcinol, quinol, pyrogallol, and protocatechnic acid, and diketopiperazine in 10 to 15 per cent aqueous soluiton were boiled together in the presence of a few drops of 10 per cent sulphuric acid. The solution was quickly cooled, the precipitate filtered off, washed with a small quantity of cold water, recrystallized twice from water, drained, and dried in a desiccator. The resulting compounds were decomposed by phenol solvents, and also by heat. Ortho- and metaphenols yielded diphenol products, whereas paraphenols gave monophenol products. A carboxyl group in the phenol increases the number of molecules of ditetopiperazine which combine with the phenol. The presence of a carbonyl group in the phenol caused the formation of compounds which could not be decomposed by solvents but which were not further investigated. Quinol gave two products, a colorless labile form and a stable colored variety. The phenol-diketopiperazine compounds are usually considered to be molecular compounds.

On heating gelatin in phenol at 70 deg. Cent. (157 deg. Fahr.) for varying periods, Herzog and Krahn, *Z. physiol Chem. 134*, 290-5 (1924), found that the gelatin dissolved and the amino nitrogen progressively diminished, while the total nitrogen remained unchanged. They believe that this indicates the formation of diketopiperazines. When wool was treated in the same way, it was first swollen, then converted into a slimy mass, and dissolved after 8 to 10 minutes at 175-80 deg. Cent. to a clear, pale, reddish-brown solution. A part of the original amino nitrogen appeared as ammonia nitrogen in the product, and up to two-thirds of the sulphur was split off as hydrogen sulphide.

Meunier and Seyewetz, *Collegium* (1924), 523-7, have shown in connection with the various quinones on leather and gelatin, that both the reaction and product obtained are similar to those of the natural tannins, and are very stable.

Enzymes

The statement frequently appears in the literature that practically all proeins may be hydrolyzed by trypsin and most of them by pepsin. Apparently the keratins are an exception to this rule. Smith, *J. Chem. Soc. 46*, 1398 (1884), appears to be the authority for the statement in Thorpe's "Dictionary of Applied Chemistry" that keratin is unaffected by either pepsin or trypsin. Dreaper, "Allen's Commercial Organic Analysis," Vol. VIII, doubts this statement and Barritt, *J. Textile Institute 17*, T111-26 (1926), says that they are probably acted upon by trypsin, since the keratoids undergo digestion in the small intestine, and keratin has been used for coating pills intended to act upon the small intestine. Bogue, according to Table XIX, appears to be doubtful upon this point.

The fact that the optimum activity of pepsin is at pH 2.0, while that of trypsin is at pH 8.0, and erepsin at pH 7.8, would lead us to expect the last two to be more energetic in their action on wool (iso-electric point pH 4.8) than that of pepsin.

In writing on the proteolytic enzymes, E. Herzfeld, *Biochem. Z. 64*, 103-5 (1914), says that the peptones exert a proteolytic action comparable with that of pepsin, but only towards their parent proteins. For instance, albumin is decomposed by peptone from albumin, but not by silk peptone. The amino acids also exhibit tryptic activity; however, this does not appear to be specific like the peptic action of peptone. Herzfeld suggests that the active constituents of pepsin and trypsin are respectively peptones and amino acids, that is, compounds identical with or similar to the products of their activities.

Damianovich and Guglialmelli, *Rev. gen. mat. col. 18*, 161-5 (1914), in investigating the effect of dyes upon the action of enzymes on proteins, found that the acid dyestuffs have a powerful inhibitive action, even at great dilution, upon the digestion of albumin by pepsin in an acid medium. Picric acid has a perceptible effect at a concentration of even 0.0001 per cent. The action is increased with the concentration of the dyestuff and is always accompanied by a staining of the albumin. In some cases, for example, with Ponceau 2R, Erythrosine, Chloramine Yellow, Congo Red, etc., a precipitate is produced. In general, the basic dyes are without action but in a few cases (Methylene Blue) the more concentrated

TABLE XIX.—A COMPARISON OF THE PROPERTIES AND REACTIONS OF KERATIN AND ITS CONGENERS

Physical Properties	*Keratin*	*Gelatin*	*Elastin*	*Mucin*	*Chondrin*	*Melonin*	*Amyloid*	*Ichthylepidin*
Color	Brownish-yellow	Light amber	Yellowish-white	White, gray, amber	Amber	Black or brown	White	Gray
Swelling	Weak	Strong	Negative	Negative	Weak	Negative	Negative	Negative
Jelly consistency	Negative	Strong	Negative	Negative	Weak	Negative	Negative	Negative
Solubility:								
Cold water	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble
Hot water	Insoluble	Soluble	Insoluble	Insoluble	Insoluble	Insoluble	Soluble	Insoluble
Alcohol and ether	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble
Dilute acids	Insoluble	Soluble	Insoluble	Mostly insol.	Insoluble	Insoluble	Insoluble	Insoluble
Dilute alkalies	Insoluble	Soluble	Insoluble	Insoluble	Soluble	Soluble	Soluble	Insoluble
Reaction with:								
Trypsin	(?)	Positive	Positive	Positive	Positive	.....	Positive	Positive
Pepsin	Negative	Positive	Positive	Positive	Positive	.....	Negative	Positive
Acetic acid	Ppt.	Negative	Ppt.	Ppt.	Ppt. insoluble in excess	Ppt.	Ppt.	Ppt.
Dilute mineral acids	Ppt.	Negative	Ppt.	Ppt.	Ppt. insoluble in excess	Ppt.	Ppt.	Ppt.
Boiling with:								
Acids	Dissolved	Hydrolyzed	Dissolved	Syntonin produced	Syntonin produced	Hydrolyzed	Hydrolyzed	Dissolved
Strong acids	Dissolved	Hydrolyzed	Dissolved	Hydrolyzed	Hydrolyzed	Hydrolyzed	Hydrolyzed	Hydrolyzed
Strong alkalies	Decomposed	Hydrolyzed	Dissolved	Hydrolyzed	Hydrolyzed	Decomposed	Hydrolyzed	Hydrolyzed
Tannic acid	.....	Ppt.	.....	Negative	Ppt.	.....	.....	.....
Lead acetate	.....	Negative	.....	Ppt.	Ppt.	Ppt.	.....	.....
Protein tests:								
Biuret	Positive	Positive	Positive	Pos. (rose)	Positive	Positive	Positive	Positive
Millon's	Positive	Faint	Positive	Positive	Positive	Negative	Positive	Positive
Xanthoproteic	Positive	Faint	Positive	Positive	Positive	Positive	Positive	Positive
Adamkiewicz	Negative	Negative	Negative	(?)	Negative	Positive	Positive	Negative
Molisch	Negative	Negative	Negative	Positive	Positive	Positive	Positive	Negative
Sulphur	Positive	Negative	Positive	Positive	Positive	Positive	Positive	Positive
Principal decomposition products	Leucine and Cystine	Glycine and Arginine	Glycine and Leucine	Leucine and Phenylalanine	Leucine and Glycine	.....	Leucine and Arginine	.....

solutions have an accelerating effect. In similar experiments on the digestion of casein by pancreatin in an alkaline solution in the presence of dyestuffs, with certain exceptions the results were the reverse of those obtained in the acid medium with albumin. In this case the basic dyes appear to have an inhibitive action, while the acid dyes are inactive.

Sperry and Rettger, *J. Biol. Chem. 20,* 445-59 (1915), investigated the behavior of bacteria towards purified animal and vegetable proteins and found that aerobes and facultative anaerobes, and even extremely active putrefactive anaerobes, are incapable of attacking and decomposing pure proteins. Solutions of the proteins are decomposed when they contained peptone or other nitrogenous food for bacterial development. In such cases, the proteolysis of the protein results from the action of an enzyme produced by the bacteria during the process of rapid multiplication.

Lloyd, "Chemistry of the Proteins" (1926), page 53, states that the normal keratins are not attacked by pepsin, trypsin, or bacterial tryptases, and that their resistance to decomposition and to digestion by enzymes suggests that there must be some special structural linkages in the keratin molecule. It is very probable that the unusual resistance of the keratins to the action of the proteolytic enzymes is closely related to their structure which is probably of the anhydride ring type. The fact that the action of certain reagents appears to open these rings, after which the keratins are susceptible to enzymic attack, supports this theory. Boiling water seems to be particularly active in opening up these rings. For instance, collagen which appears to be the anhydride of gelatin, is readily hydrolyzed by trypsin aftertreatment with boiling water. It therefore appears very probable that wool will be much more liable to enzymic attack after it has once been treated with boiling water. Probably other of its properties are also altered more than we realize by the boiling treatment.

Dakin and Dudley, *J. Biol. Chem. 15,* 263 and 271 (1915), have shown that after racemization the proteins are completely resistant to the action of the proteolytic enzymes, which further indicates that the keratins may not have the usual protein (peptide) linkage.

Stary, *Z. physiol. Chem. 136,* 160 (1924); *144,* 147 (1925), found that under the action of bromine and glacial acetic acid hair is converted into a soluble and digestible form. After this treatment the keratin no longer gives carbonyl reactions and it has been suggested that its anhydride rings have been opened to form peptide chains.

Keratin reacts with Millon's reagent and gives the xanthoproteic reaction, as shown in Table XIX, which gives a very complete summary of the keratin reactions, as compared with its congeners. This table is from Bogue's "Chemistry and Technology of Gelatin and Glue," page 80.

(*This completes the ninth paper of the series on wool by Chas. E. Mullin. The next paper of the series will review the literature on the action of the acids on wool, keeping the hydrogen ion concentration factor in mind. It will appear in an early issue.*)

UNITED INDIGO OPERATIONS SHOW PROFIT

At the recent annual meeting of the United Indigo & Chemical Company, Manchester, England, it was reported that the profit for the last fiscal year was £17,111. This is a decrease from the previous year, when the profit was £21,440, but in his address to the stockholders the chairman of the company said he was satisfied to know that profits had been made in the face of severe handicaps brought on by last year's conditions of trade. All the company's subsidiaries, with one exception, showed a profit over last year.

COLORS FOR PAINTERS FOUND IN ODD PLACES

The origin of many common colors is found in unexpected places. Turkey Red is made from the madder plant of Hindustan, while Prussian Blue comes from fusing horses' hoofs and other refuse animal matter with impure potassium carbonate. Other color sources are recorded by Tid-Bits as follows:

Gamboge is from the yellow sap of a tree in Siam. India ink is made from burned camphor and mastic comes from near Sienna, Italy, while umber is an earth found near Umbria. The charcoal of the vine stock produces blue black.

The camel furnishes Indian yellow and the cuttlefish gives sepia, which is an inky fluid which the fish discharges when attacked. Bistre is the soot of wool ashes. Scarlet is iodide of mercury, vermillion is from the ore cinnabar, and Chinese white is zinc. Carmine, crimson, scarlet-carmine and purple are furnished by cochineal insects.—Paterson Call.

DU PONT EXHIBIT AT SOUTHERN TEXTILE EXPOSITION

The Du Pont Rayon Company and the dyestuffs department of E. I. du Pont de Nemours & Co., Inc., are combining in a show at the Southern Textile Exposition to be held at Greenville, S. C., November 1 to 6. The show will feature combinations of rayon, both dyed and undyed, Du Pont dyes being used in the preparation of the exhibit. The fastest Du Pont colors, especially the vat and developed colors, will be featured. Representatives of both the Du Pont Rayon Company and the dyestuffs department of the Du Pont company will be present to greet friends and discuss mill problems.

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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SEPTEMBER MEETING OF THE NEW YORK SECTION

The September meeting of the New York Section of the American Association of Textile Chemists and Colorists convened in the Machinery Club, 50 Church Street, New York City, September 24, 1926, at eight o'clock, Herbert Grandage, chairman, presiding.

. . . The routine business of the Section was transacted, following which Chairman Grandage announced that the author of the first paper to be presented, Mr. Dillenius, was unable to be present and that the paper would be read by Mr. Knowland. Mr. Knowland presented this paper, entitled "Possible Research Developments in the Rayon Field."

Possible Research Developments in the Rayon Field

By JOHN F. DILLENIUS
Consulting Chemist, Newark, N. J.

The science of structural organic chemistry is only fifty years old; and yet a considerable achievement has been made in so short a time, in the knowledge of many of the reactions and properties of the more simple complexes of carbon in combination with oxygen, nitrogen, hydrogen and other elements.

Much yet remains to be done before we can attack with any real hope of success the problems which the chemistry of nature presents. The knowledge already gained has led to the synthetic preparation of quite a number of natural products, many of which are of service in relation to human needs, and to which, during the present very strenuous time in the textile industry, belongs the manufacture of synthetic fibers, such as artificial silk, wool and cotton. The perfect development of these lies yet in a cradle and presents an unlimited field of scientific research.

The present trend of fashions evidenced in the last few years presents a very definite problem. The relative methenation law which governs the whole cosmos is transferred from one stage to another as science and culture grows. Emancipation of woman and her esthetic taste . . . there lies the doom of the cotton industry. The beautiful and attractive effects of ladies' fashionable costumes depend largely upon the delicate luster and translucency of the fabric; these properties are inherent in artificial silk and other artificial fibers. From daily observation everyone is convinced that women wear 75 per cent silk garments against 25 per cent of cotton, and this fact demonstrates that the manufacture of artificial fibers embodies an immense field of creative research.

Naturally the human senses are so constituted that they always strive for beauty. This desire becomes more acute with the progress of time.

In the remotest antiquity the women decorated themselves with natural products, like lustrous feathers, furs, etc. This desire for beauty will never die out, but will constantly grow.

The manufacture of artificial silk will also grow and be a serious depressing competitor to cotton. During the last few years the demand for more lustrous fibers for embroidery and chochet purposes has increased, and in a short time ordinary mercerized articles, to a great extent, will be replaced by more lustrous fibers.

Up to the present time an artificial sewing thread has not been produced, but it is a certainty that those alert in science will perfect the artificial fiber that will be used universally at a production cost within reasonable limits.

There are several agencies which support the present trend toward a constant style change, particularly in the field of women's wear. Daily education through the medium of artistic fashion magazines, which are easily made available, elaborate moving picture portrayals of an ever-changing fashion in women's wear, are active supports to this trend. The desires encouraged through such agencies demand a constant change of styles which can be satisfied only with fabrics and fibers corresponding in physical appearance and properties to genuine silk. These demands unquestionably are offering new life to the textile industry.

Just as surely as the present advanced stage of society demands the radio and auto as a necessity, so will it demand in fashion that brilliancy and novelty only possible through the construction of new artificial fibers. It is a definitely accepted fact, I believe, that at no future time will the trade demands be satisfied with the so-called staple products and a return to the conservative modesty in style of ten or twenty years ago.

It must be concluded that the accelerated trend for novelties and the success of the cotton textile industry depend largely upon technical research work, to bring its fibers or fabrics to a more desirable appearance in keeping with the novel modes of the day. At this stage there is required a careful study of a fantastic market for seeing the longer or shorter demands.

The development of a new article or a new finish necessitates toilsome work, and can only be achieved by inspiration, intuition and a close study of the secret processes of nature. The manufacture of artificial silk is the effort to reproduce one of nature's most wonderful products. The modern rayon plant is man's attempted substitute for the silk worm.

Such intuition and brilliant emotions as dictated the world's stirring symphonies to the classical musical composers is required in the textile field to-day.

The newest and most important problem which lies before the textile trade for research development is to produce, partly, if not wholly, an agreeable, soft luster of true silk character, direct on the fiber or fabric. Undoubtedly it is a difficult enterprise, but in the presence of the many technical achievements of the past, which once seemed only dreams, an impossibility can not exist, and I commend this problem to you for your earnest thought.

Chairman Grandage—I might say in fairness to Mr. Dillenius that that paper is simply the outline of a number of theories he has been working on and is still working on, to develop, and I felt when I requested Mr. Dillenius to write that paper for us that if he were here he might have been more than interesting to a great many of us if he could have told us about his work. I believed when I asked him to write the paper that he would be here. Unfortunately, he could not come. It would have been valuable for you to have had Mr. Dillenius outline how far he has gone in accomplishing the achievements he mentioned as the last topic in his paper—the development of a luster direct on the fiber or on the fabric itself.

The next paper is to be presented by C. W. Johnston—"Liquid Sulphur Dioxide and Its Uses in the Textile Industry." Mr. Johnston has come from quite a distance to present this paper to us, and I am quite sure it is going to be worth while. Mr. Johnston! (Applause.)

Liquid Sulphur Dioxide and Its Products, and Their Uses in the Textile Industry

By C. W. Johnson

General Manager, Virginia Smelting Company

Mr. Chairman, members of the American Association of Textile Chemists and Colorists, and guests: I appreciate very much the honor which Dr. Killheffer conferred upon me in asking me to come here this evening, and I am very glad to be here. I hope I may be able to tell you in an interesting way something of sulphur dioxide and its uses in the textile industry.

If I say anything that seems odd and strange to you, I hope when I am through you will give me a chance to try to explain, if I can, because perhaps it will develop that I really haven't said what you think I have. I come from down in the Southland, and associations down there may perhaps lead me, after I forget myself and all this that I have prepared, and launch forth in talking about a subject in which I am very much interested, to cut my words and maybe you won't understand what those words mean.

That reminds me of the story of Sam, an old colored fellow on one of the plantations in Virginia. You know, we call even the smallest farms down there plantations. Sam had been with my friend, the owner of the plantation, for a number of years. One evening the owner of this plantation had invited to his place a very learned Englishman. It was the Englishman's

first visit to the Southland and he was particularly interested in darkeys.

He arrived there late that evening, but was up the next morning about sunrise and out for a walk. The first person he saw was this darkey, Sam. He was anxious to talk with Sam, and yet he didn't really know what he ought to talk to him about, so he thought he would do as they do in England when they don't know what to talk about; he would talk about the weather.

Sam said, "Good morning, suh."

The Englishman said, "Do you think it will rain?"

Sam gave him a typical Southern darkey's answer, and the Englishman went no further. He felt the darkey was making fun of him. He said no more but went back, and at breakfast his host asked him where he had been. He explained that he had been out; that he had met this colored man, asked him a perfectly civil question as to whether he thought it was going to rain, and the colored man had given him a most astounding answer. Naturally, the host was interested and said, "Just what did old Sam say?"

"Well," the Englishman said, "I asked him if he thought it was going to rain and he said, 'Little dogs it will and little dogs it won't.'"

Of course, my friend the host thought that it was very strange and he couldn't understand what Sam had meant. He asked the Englishman to walk out with him and together they walked out and found Sam. The Virginian said, "Sam, I am surprised at what I have learned. This is my friend and he asked you a very civil question and you seem to have answered him in a very strange way."

"No, suh; no, suh, I didn't," said Sam.

And the host said, "Well, Sam, what did you say? Tell me, now."

"Well," said Sam, "he axed me if I thinks it is going to rain."

"That's right; and now, what did you say?"

"Well, I says 'P'ups it will and p'ups it wont.'" (Laughter.)

When I get through, I may find that I have said "p'ups" in place of perhaps, so please give me a chance to explain.

Coming from the South, if I didn't make an opportunity here to-night to say something of it, I couldn't go back (laughter); they wouldn't let me. They are all boosters down there. Why, Norfolk—Hampton Roads—is the finest port on the Atlantic Coast south of New York. Even the farmers around there are progressive. They not only grow all the potatoes and other vegetables and fruits which come up here to feed you people, but they have gone in for the growing of cotton and they have some magnificent cotton fields around there.

But, just like the farmers every place else, those fellows are not satisfied; and when you ask them, as you meet them and look over their cotton fields with them, what in the world they are kicking about, they say, "Well, it is only flapper cotton." And when you ask them what they mean by "flapper cotton," they tell you that it is might good to look at but there isn't much on it. (Laughter.)

I wish I could tell you some stories about sulphur dioxide but the only stories I know about sulphur dioxide —and this is a fact, gentlemen—are those which certain chemists hired by the manufacturers of artificial ice are to-day putting out regarding the harmful effects of sulphur dioxide. I believe those chemists don't mean to be dishonest. I think that they simply don't know what they are talking about because if you scan the literature —more than scan it, if you study the literature—with the greatest of care you will find practically no case of any serious injury from sulphur dioxide.

We know sulphur dioxide in our work as a safe gas because it makes its presence known, and if it is present in any very great quantity one can very easily get away from it. Personally, I have been working in it for the past ten years, and I have men who have been working in our liquid sulphur dioxide plant for ten years. We have had leaks of all kinds and descriptions; in one case a man was covered from head to foot with a number of hundred pounds of liquid sulphur dioxide. The doctors who examine our men and keep track of us, who are the family physicians of these men, do not find any serious or any permanent injuries from the gas. I think this is an important thing to remember. Further, I have had correspondence with some of the ablest leaders of hygiene in this country on the subject, because we certainly want to know if there are any cumulative effects, or if any one can be more than temporarily inconvenienced and distressed by breathing sulphur dioxide.

The tables published showing the quantities of sulphur dioxide that one can breathe show that a slight concentration causes trouble. But, while the effects are extremely irritating, causing one to sneeze and in fact causing one to sometimes cough until he spits blood, apparently because the gas is quite soluble in water it doesn't get into the lungs very deeply, and even when it does the body seems to be able to throw off the effects within a very short time.

The stories that are being published quite widely today I really think are based on lack of information, and if anyone here knows of published data or recorded cases of injury from sulphur dioxide, I would certainly be glad to have this information.

Sulphur Dioxide and Its Manufacture

You know sulphur dioxide gas (SO_2) as the colorless gas obtained from the burning of brimstone. When sulphur is burned in the air it is possible to get a gas running about twenty per cent by volume sulphur dioxide (but it is an extremely difficult thing to do), the balance being made up of inert nitrogen, unburned air, some sulphur trioxide, and in many cases some sulphur, because the sulphur will sublime over. To prevent this is a real job.

In this form sulphur dioxide perhaps has been used by all of you in the textile industry or elsewhere. But you know when you use it you have to use it on the spot where it is made.

To transport it, it has been combined with sodium, giving you the salt commonly known as sodium bisulphite, probably more properly sodium meta-bisulphite.

In this dry sodium bisulphite, you have about 62 per cent by weight of sulphur dioxide. But very often when you are using this product for its sulphur dioxide content, unless you use certain methods that are not generally followed, you will really only get about 30 per cent of the sulphur dioxide. In talking with one using sulphur dioxide in this form, and who buys sodium bisulphite for its sulphur dioxide content, and not also for the soda contained, I speak of the soda as a barrel to hold the sulphur dioxide.

What we have done at West Norfolk is to take sulphur gas, purify it, liquefy it, and ship it out in steel containers at 100 per cent strength.

The plant making liquid sulphur dioxide is not so simple as some might think. A real plant of any size and capacity costs a large sum of money.

The process whereby we make liquid sulphur dioxide at West Norfolk is, briefly, as follows: The plant was originally started because we have a smelter at West Norfolk, and we went into the converting of the copper matte. This work produced a gas containing considerable sulphur dioxide. We erected scrubbers to wash this sulphur dioxide out of the gas, because we are on the edge of a farming country, a quarter of a mile from where they grow those handsome potatoes and the "flapper cotton," and we did not want to discharge sulphur dioxide into the air, even from our high stacks. For some years this sulphur dioxide gas from the smelter was that from which we made our liquid sulphur dioxide, but the copper industry has decidedly changed in the last few years and our operations have had to change with it. For a number of years we have been buying Texas brimstone or sulphur, burning it in a Glens Falls rotary burner, and producing a gas which we vary in strength according to the condition under which we are working at that particular time. Usually this strength is between 10 and 14 per cent by volume.

This gas is passed up through a series of scrubbers, originally packed with slag, then packed with stone, and then packed with other things until now we have our own type of packing, for during the past ten years we have evolved a particular packing that allows the gases to pass through these scrubbers with the least back pressure and gives us a very efficient absorption of the sulphur dioxide in the water.

The gas passing up through this series of towers with the water going counter to the gases at the end is very weak in sulphur dioxide. The water starting in with no sulphur dioxide in it comes out at a strength dependent on the temperature of the water and the strength of the sulphur dioxide gas which we have put into the first scrubber.

This water, which we call a liquor and about which we are continually telegraphing (we were in the old days, I should say), once caused our plant to be raided, because the authorities happened to see a telegram which said that "the liquor wasn't good enough; make it better." (Laughter.) But this liquor is nothing more than the water containing sulphur dioxide.

We have pretty good sized storage tanks to hold this liquor, so that if anything goes wrong with the sulphur burner end we don't have to shut down the rest of the plant, and if the rest of the plant shuts down we don't have immediately to shut down the sulphur burner. These big tanks act just as a gas reserve on a city gas plant; we draw on them as needed, and we run the burners continuously.

Removing Sulphur Dioxide from the Water

After we have the sulphur dioxide absorbed in the water, and thus have removed from sulphur dioxide the inert gas, the air and many of the other impurities, the next thing to do is to get the sulphur dioxide out of the water. To do this we pump the liquor to the top of another tall tower and as it runs down through that tower it meets the exhaust steam from our turbine and is heated up. When you heat water containing sulphur dioxide, you drive out the sulphur dioxide.

The uniqueness of our plan, and I think it is the only one of its kind in the world (I know it is, and lots of these little details in the general outline we covered with patents years ago), is that we only heat the liquor to about 126 deg. Fahr., using steam from which we have already obtained the power to run the whole plant. When the liquor is heated to 126 deg. Fahr., it is under a high vacuum, and from this piece of apparatus practically pure sulphur dioxide gas is drawn

toward the first vacuum machine. With this sulphur dioxide gas there is water vapor, and when water and sulphur dioxide come together they give you about as corrosive a substance as I have ever encountered, so that a large amount of the time and effort of the early experimenters in making liquid sulphur dioxide was devoted to corrosion trouble and to getting rid of that moisture.

In some places they get rid of it by using sulphuric acid, phosphorous pentoxide, calcium chloride, refrigeration and other things. We use absolutely no chemical whatsoever. We use a method of our own based on the physics of the thing more than on the chemistry of it, and we have succeeded in making a final product for refrigeration work which contains less than two one-hundredths of 1 per cent water by weight.

Analysis of sulphur dioxide for such extremely minute quantities of water is most difficult. We couldn't find a chemist in the United States who could tell us how to do it. A number of them wanted to do research work on it, but we went ahead and have a process that has been recognized by others as one that gives accurate results. If anything, this method will give high water content rather than low, a thing that is better for purchaser than producer; but we are willing to accept purchaser's analysis.

Our commercial product will run about two-tenths of 1 per cent moisture.

To get back to my story, this water vapor and SO_2, leaving the tower where it has been liberated from the liquor in which it was dissolved, is passed through cooling towers and cooling coils, condensers, through machines where it is compressed, then cooled, to take out the heat of compression again, and is finally liquefied under a pressure of about 100 pounds per square inch and at the temperature of the sea water which we have for cooling.

Properties of the Product

This liquid sulphur dioxide is water-white. You could put it in this glass and it would look exactly like water. You can actually take liquid sulphur dioxide, pour it out into a glass and show it around. If you were visiting with me I would do that for you, and then I would pour it out over your hands, because our sulphur dioxide, not brought in contact with any chemicals, we have never found to be injurious to the skin, and pouring it on the hands is a demonstration of the cooling effect when the liquid sulphur dioxide boils.

It will boil at 14 deg. Fahr. under normal atmospheric pressure and temperature. When you have poured it out in this glass it will cool itself almost immediately to 14 deg. And while during that process there are considerable fumes—and you wouldn't want to put your nose right over it—if you should take it outdoors and stand to windward of it you would not smell it. After it has cooled itself down the evaporation will be quite slow. I should say even in this room to-night, where it is quite warm, it would take an hour anyway for a glass of liquid sulphur dioxide to evaporate entirely.

It is shipped in steel containers, the smallest one which we have holding ten pounds, very convenient sizes being the 35-pound and 150-pound containers. The next is a 2,000-pound drum and the next is 40,000-pound tank car. It is very easy to move sulphur dioxide around and transfer it from a tank car to a storage tank at your plant. It is moved by its own pressure. If I should ship you a tank car of 40,000 pounds you would connect it up with your storage tank in such a way that you would have a higher pressure in the tank car than in the storage, wherever it might be—on the second floor, down in the basement, or on the ground. Having that higher pressure in the tank car in which you receive it, this higher pressure will force the liquid into the container which is at a lower pressure. You can empty a tank car of 40,000 pounds in about six hours.

Having succeeded in making liquid sulphur dioxide, we found we had only done a small part of our work, because after we had made it, no one wanted it, and it has been our work during the past seven or eight years to study the situation to see where liquid dioxide might be used advantageously. Having found those places, it has been necessary to study how liquid sulphur dioxide could be adapted to those processes, and once having answered those two questions (that is: Can the man use it to advantage, and can it be adapted to his process?) we made sales, and we have continued to have those people to whom we first sold it as our customers, and have gradually built up a business, until to-day I believe (I would not make this as a positive statement, because I don't know, but I have been so told) that our plant is the largest producer of liquid sulphur dioxide in the world.

Uses of Liquid Sulphur Dioxide

What are some of its uses? Perhaps its use as an antichlor might be the simplest. Its use there is dependent on the well-known reaction that sodium hypochlorite plus sulphur dioxide (which in water is sulphurous acid) will give sodium chloride plus sulphuric acid.

I know that someone will immediately say, "Oh, sulphuric acid—I wouldn't have it on the cloth!" But when you stop to think that in this work, the concentration of sulphur dioxide that you would use as an antichlor is about .025 of one per cent, you will see that the total

amount of sulphuric acid that can be formed by the neutralization of the bleach you have left on the cloth is so extremely small that it can't possibly do any harm.

Further, I think there is a chance that sulphuric acid formed at that point, unless it is so weak that the reaction would not take place, will immediately react with some more of the bleach and thus be itself destroyed and form a soda salt.

The action of sulphur dioxide is very, very rapid. You might take a piece of cloth, dip it in a strong bleach, remove the piece of cloth immediately, and put it in a bucket containing sulphurous acid no stronger than .025 per cent, and before you could get the cloth out the chlorine would be destroyed. You can test that cloth with starch iodide solution and see that there is no chlorine there, and you could test it with Methyl Orange for its acid content.

The quantity of sulphur dioxide you use as an antichlor is very, very small, which makes the sales problem very hard, because even the largest bleachers will use but a little of this material. Perhaps a half-pound to a thousand pounds of goods is rather high. You will easily see that the quantity you use will depend, first, on how well you have washed your goods after you have bleached them; and on the kind of goods. If you have a heavy toweling, it will retain after washing more of the bleach than a light, thin piece of goods. We have had sulphur dioxide used directly after the bleach without any washing, and have had some of the washings eliminated after the antichlor treatment.

Sulphur dioxide is not to be used in place of a white sour. Its action is much more mild than that which you get when you use acid as a white sour. Yet the goods after being antichlored with a sulphur dioxide are practically as white, in some cases whiter, than where you have used the white sour. They are certainly softer, because you have avoided depositing on the goods, or you have saved having to wash off of the goods some of those salts which you get where you use acids. The action is very rapid. You may save considerable time in washing, and it has been proven in actual practice the cheapest antichlor there is.

Economy

I think the question of cost perhaps needs some explanation. When you use sulphur dioxide, you can't waste it. The man in your mill won't waste it because as soon as he gets a little too much in his solution, he begins to smell it and every one else begins to smell it. It won't hurt anyone but it is disagreeable, and he won't put in more than he needs, except, perhaps, for one or two times.

If you use some of these other sours it is very easy to use a good deal more than you need; and while the managers and the chemists give their orders and want the men to follow instructions, it is very easy to put in a little more to be sure and get the results. So that when I say that sulphur dioxide has proved the cheapest antichlor I hope you won't pin me down to writing the reaction and proving by the reaction, but take my word for it that from actual experience of those who are using it and those who were kind enough to give us the figures, it has been shown that that is so.

You may wonder why you can't use burner gas in place of liquid sulphur dioxide. Why buy liquid sulphur dioxide for this antichlor? You can use burner gas as an antichlor, and probably a good many of you have used it, but you know the troubles you have with it. The sulphur will go out when you don't want it to go out. It will get too hot and the sulphur will sublime over, and some day the apparatus is eaten up and you have to have it all repaired. So that while sulphur dioxide when put down side by side with burner gas, as far as costs go, doesn't look at all favorable, when compared for a year's run it does compare favorably, and it is because of this and of its simplicity that it is being used in place of sulphur burners.

The sulphur dioxide shipped in cylinders is a liquid, but over that liquid there is a small quantity of gas. If you draw from the cylinder while it is standing in an upright position you will draw gas. More liquid will immediately evaporate, filling the space from which you have drawn that gas. This evaporation will cool the liquid down, and should you draw from the cylinder too rapidly the cooling will be carried to such a point that the evaporation may entirely cease —and we have done that in order to take out a valve that has come back damaged—just simply blown the gas down until it was cold enough so that there was no pressure in the cylinder.

Use as an Antichlor

When it is used in the cotton mills for an antichlor, the cylinder can be set upright, connected with a hose to your antichlor pit if you are bleaching in the rope form. The valve can be turned sufficiently so that you can get a constant flow, and you don't need anything more than a wrench and a little piece of hose—and we will be glad to furnish the hose.

It is simple. When first looked at, it would seem as though this thing was most crude, as though the man would have to test by chemical means the strength of the sulphurous acid in his antichlor pit; but his nose soon becomes the best test. He just takes up in his hands a little of the solution from the pit and

sniffs it, and he becomes very proficient in telling when the strength is about 0.025. If for any reason the gas should go off for a minute, the gauges which you might put on that line will indicate it, or the man watching the pit and testing this way every few minutes will catch it. If you get too much, one will smell it distinctly around pit. The man who is looking after it will smell it first and shut off the valve a little.

Making Hydrosulphites

Another use for which sulphur dioxide has found a market is in the making of hydrosulphites. I think you are all familiar with this group of chemicals, the soda salt of which has the formula $Na_2S_2O_4$. This salt was first discovered and worked with back in 1718, but it was not until along about 1869 (when Schutzenberger succeeded in making it as a dry salt—it is known to many as Schutzenberger's salt, and is also known under various trade names) that it was more commonly used. In the making of this salt sulphur dioxide and zinc dust are brought together in a water solution and a zinc hydrosulphite is formed. Then the zinc is precipitated out, by the use of caustic, soda ash, lime or a combination of these things, leaving the soda salt, let us say. The zinc is filtered off; the soda salt is in solution; and then, if one wishes to make the dry powders he recovers them in various ways which really are only known to the manufacturers of these dry powders. There is something written about it, but there is probably some joker in what has been written. Anyway, the recovery of the salt and putting it on the market as a solid sodium hydrosulphite isn't an easy task. It has been accomplished by our chemists over here in America, and you know that there is a very good product on the market.

The interest of the Virginia Smelting Company in studying this salt started when we couldn't get this dry product over here. They developed a method of making the solution containing the sodium hydrosulphite, and to-day there are in some of the mills that use sodium hydrosulphite in sufficient quantities to warrant them in making it, plants which we have designed to meet the specific requirements of each individual customer.

Storage of Hydrosulphite

Sodium hydrosulphite is a fickle lady. It tends to break up, and its keeping properties are not good; but we do have, in connection with any plant that we design, a storage unit sufficiently well built so that these solutions can be kept overnight, and in some cases for several days without material deterioration. The general practice is to train one or more workmen (and we consider this as part of our services) well enough so that when he follows directions he will get uniform results.

A man coming to work in the morning will make the hydrosulphite that is to be used that day. It takes about three hours from start to finish until the press is all clean and everything is shipshape, to make a batch anywhere from 100 to 900 or 1,000 pounds of the equivalent commercial sodium hydrosulphite. While this batch is being made, they use the hydrosulphite that was left over from the day before for springing vats, and getting started.

The reason, and the only reason, for one making one's own hydrosulphite is purely an economical one. It is a question of costs. It can be made in one's plant considerably cheaper than one can buy the powders. If one uses enough hydrosulphite and uses it with sufficient regularity, then it is a question whether the saving that he can make warrants him in doing something himself which he doesn't need to do, because he can buy what he wants but he has to pay more money for it.

There is one point I would like to mention, and I don't give this as my opinion, but only as what has been told to me by those who are using these solutions. I think it has some merit and is worth the study of those who are interested. This point is that this freshly-made hydrosulphite may be a little better than any solution made from the powders. That is, it is a freshly made substance and it appears to react at a little lower temperature and with a little more strength than when one used powders and dissolves them.

Rongalite and Various Strippers

Another thing is that these solutions are not only being used in the denim mills but they are used and have been used by a number of dyers on vat colors. There it is a problem for each man to decide whether the saving that he would make would be commensurate with what he may think is a risk. I don't believe there is any risk, but he may think so, and his peace of mind may be worth more than the few hundred dollars he might save a month by making his own hydrosulphite.

Rongalite is another hydrosulphite which you all know. This is sodium sulfoxalate or sodium formaldehyde, hydrosulphite. This is used in printing discharge work; it reacts at a higher temperature than the normal sodium salt

Then, you are all familiar with the various strippers, many of which are made from sulphur dioxide. There are a number of good ones on the market. The problem of strippers, as we see it, is for the man to fit the stripper to his own particular requirements.

The composition of these strippers varies considerably. Each manufacturer, naturally, makes what he considers offers the best for the least money to his customers, and this group is probably growing and more and more we will hear from it. It may be that other strippers which are not made with sulphur dioxide will appear on the market. I have heard of them. Frankly, I haven't happened to have any success in finding any that would strip, although I have had some samples. It may be I don't know how to use a stripper that isn't made from sulphur dioxide.

In the general dye works, we have studied the possibilities of the use of sulphur dioxide and there is going on to-day research work in our laboratories and in some of the dye plants on the making of certain kinds of dyes, and on the making of certain intermediates in which sulphur dioxide may be used, and although this isn't a use where you men in the actual field come in contact with it, anything that helps in the making of those things which you do use in turn helps you.

If I have said "p'ups," I would like to see if I can say "little dogs." Thank you, gentlemen. (Applause.)

Discussion

Chairman Grandage—Gentlemen, there are probably some questions that you would like to ask Mr. Johnston. If it is not about "p'ups" it might be about sulphur dioxide. If you will get them under way, Mr. Johnston, I am sure, will do all that he is able to answer them to your satisfaction.

Mr. Harrold—I would like to ask if those laboratory cylinders that you mentioned are returnable or do they have to be kept?

Mr. Johnston—We started out with a ten-pound cylinder and figured that we wouldn't take it back. We found this worked a hardship, and for the past six to nine months we have changed our policy and are willing to take those cylinders back; we charge them out at about what they cost us. We have been working for two years to get a better cylinder, one that we could furnish the trade more cheaply, because ten-pound cylinders are more trouble than they are worth. If I may, I should like to make this suggestion right here: When you order a ten-pound cylinder of sulphur dioxide (and I guess it is the same with any other gas), the cost of getting that gas to you is not the cost of making the gas that is in the cylinder, but it is the handling of that cylinder. And most those buying them want them sent to the express office. It often costs us more than we get out of the whole job just to get them to the express office. Then they cost the customers money. A cylinder holding thirty-five pounds of sulphur dioxide is a returnable cylinder. In our case the deposit charge is $15, and you can buy that thirty-five pounds of sulphur dioxide for practically no more than you would pay for ten pounds. A thirty-five-pound cylinder will weigh about eighty-five to ninety pounds. It is not too awkward to handle around in the laboratory.

We have now worked out a cylinder (the Bureau of Explosives has given permission for its use) which was ordered for delivery September 1, but it hasn't got there yet. It is going to be a very much lighter cylinder and one that we believe we can put out to the trade at a cost very much less than the $12 that we have to ask for the ten-pound cylinder. If you have one of our ten-pound cylinders and will send it back, we will be glad to take it back.

Mr. Harrold—I was thinking about the old days when we paid ever so much more for the cylinders than for the gas, and we had a store of cylinders; we never could return them or do anything with them.

Mr. Johnson—We will fill any cylinder that meets the requirements of the Bureau of Explosives. But we have had all kinds of cylinders sent in to us which were unfit for use; I don't know how they got by in the first place.

Mr. Harrold—Can you get them from the chemical supply houses and return to the chemical supply houses?

Mr. Johnston—In some cases. We have some stocks in various cities around the country. But there again we are up against the proposition of buying a small quantity of sulphur dioxide in a supply house. It is merely a business proposition. There is nothing in it for the manufacturer, anyway, no matter how much he charges you. He can't charge you, say, $2 for ten pounds of sulphur dioxide and have it stocked in a supply house who has to charge you $3. But if he charges you $2 and then has to allow the supply house man his profit, the manufacturer is still worse off. We have tried to overcome these troubles by carrying stocks in such places as Boston, New York, St. Louis, Cincinnati, Denver and San Francisco, and in those places we can always make immediate delivery of any kind or any quantity.

J. F. Branscom-Doyle—What action will the sulphur dioxide have on Monel metal?

Mr. Johnston—Sulphurous acid will attack Monel metal, but Monel metal is all right in liquid sulphur dioxide, as far as we know. We use it for stems in our valves and it stands up so long as we ship what we should, a dry sulphur dioxide. But if any moisture gets into that cylinder, the Monel metal does not stand up.

In the dyehouses, I have seen Monel metal drums for dyeing used in connection with some of these hydrosulphite compounds, and it has been all right. With others,

it has turned black. So I think it is an individual problem there as to the particular conditions.

Mr. Branscom-Doyle—Does it turn the Monel black, or the goods black?

Mr. Johnston—It turns the Monel metal, itself. I didn't see the result on the goods.

Chairman Grandage—Are there any more questions? If not, I want to express, on behalf of myself at least and the Association I am sure, or this local section of our Association, our appreciation for Mr. Johnston's very thorough covering of the subject that he presented to us to-night. If you have no further questions to ask him, a motion for a vote of thanks is in order.

. . . It was unanimously voted, upon motion regularly made and seconded, that a rising vote of thanks be extended to Mr. Johnston. . . .

Mr. Johnston—I certainly appreciate this, gentlemen. It was a pleasure to come here.

I meant to say that if anyone is interested, there did appear an article by one of our chemists, Mr. Scribner, in an issue of the Textile Colorist. If you didn't happen to see it, I have some extra copies in my brief case outside. Then also we have a little pamphlet on "The Use of Sulphur Dioxide as an Antichlor," which goes into the matter in more detail than I was able to do.

You know, a manager is supposed to know it all but I want to tell you in my case I have some chemists (and all of our salesmen are chemists) who do know about these problems, and I wish it had been possible to send them here. These articles were written by those men, and if you are interested I will get some copies for you.

Chairman Grandage—If there are no matters which you care to bring up, we stand adjourned.

. . . The meeting adjourned at nine-fifteen o'clock.

FORTIETH COUNCIL MEETING

The fortieth meeting of the Council of the American Association of Textile Chemists & Colorists was held at the Engineers' Club, Boston, Mass., on October 1, 1926.

The following members were in attendance: Prof. L. A. Olney, E. H. Killheffer, W. C. Durfee, G. A. Moran, W. R. Moorhouse, W. M. Scott, H. W. Leitch, W. H. Cady, H. Christison, W. S. Williams and W. E. Hadley.

Letters were read from R. E. Rose, R. F. Culver, and W. D. Livermore expressing regret at their inability to attend the meeting.

The following applicants were admitted to membership:

Active Members

Clark, J. Andrew, instructor, Rhode Island School of Design. Address: 39 Salina Street, Providence, R. I.

English, Chas. B., chemist, National Duo-Dye Company, Paterson, N. J. Address: 71 Milford Avenue, Newark, N. J.

Firth, Elwood, T., demonstrator, Sandoz Chemical Company, Red Bank, N. J. Address: 708 Washington Street, New York, N. Y.

Fletcher, E. L., chemist. Address: Burkart-Schier Chemical Company, Chattanooga, Tenn.

Green, L. E., demonstrator and salesman. Address: Du Pont Company, Charlotte, N. C.

Hall, Frank E., color mixer, Consolidated Piece Dye Works. Address: 119 E. Twenty-second Street, Paterson, N. J.

Klotz, Oliver G., chemist-superintendent of dyeing. Address: Riverside, N. J.

Morningstar, R. P., sales manager and technical executive. Address: 650 W. Thirty-fourth Street, New York, N. Y.

Skalnik, Karl M., colorist, National Duo-Dye Company, Paterson, N. J. Address: P. O. Box 473, Metuchen, N. J.

Sullivan, W. M., chemist, American Woolen Company, Andover, Mass. Address: 28 Olive Avenue, Lawrence, Mass.

Wheeler, Wm. S. Jr., research director. Address: McCallum Hosiery Company, Northampton, Mass.

Junior Members

Snowden, Donald C., dyer, Cadet Knitting Company. Address: 3538 Sunnyside Avenue, East Falls, Philadelphia, Pa.

The following members were transferred from Junior to Active Membership: Herman Arrow and Robert W. Jaeger.

In accordance with the terms of the Constitution the Secretary was instructed to immediately send out the Nomination Ballots for Officers for 1927.

Attention was drawn to the fact that desired amendments to the Constitution must be placed before the Council one month before the Annual Meeting.

Dues

Several members have not paid their dues for the year 1926, and by vote of the Council, unless such dues are paid by November 1 their names will be removed from the mailing list. The Chairmen of the Local Sections will be supplied with a list of the delinquent members within their section, in order that an effort may be made to settle this matter. It was decided that in the future the names of delinquent members will be removed from the mailing list on May 1.

Application for the formation of a new Southern Section was considered, but action was deferred to the next Council Meeting.

ANNUAL MEETING

Dr. E. H. Killheffer is putting a great deal of time into preliminary work to arouse the interest of the Northern members toward attending the Annual Meeting to be held in Charlotte on December 3 and 4.

The Committee is particularly desirous of obtaining as many definite promises as possible, in regard to those members who will attend the Annual Meeting, in order that definite arrangements can be completed.

If 250 members attend the Convention, it will be possible to travel at a reduced rate; the full detail of the plan to be followed is to be printed in the Proceedings. It was pointed out that if 125 attend from the vicinity of Philadelphia and New York, a special train will be provided.

A great deal of time was devoted by the Council to the selection of proper subjects for the Forum and general meeting in the South.

Dr. E. H. Killheffer, on behalf of the New York Local Section, extended an invitation to the Council to hold the 1927 Annual Meeting in New York City. The invitation was accepted.

It was voted that next Council Meeting will be held on November 5, 1926.

Respectfully submitted,

W. E. HADLEY, *Secretary.*

Railroad Information on Reduction Plan for Annual Meeting Trip

Suggested advice to members of the organization respecting reduction authorized on the Certificate Plan for benefit of members and dependent members of their families.

A reduction of *one and one-half fare on the Certificate Plan* will apply for members attending the meeting of American Association of Textile Chemists and Colorists, to be held at Charlotte, N. C., December 2-4, 1926, also for dependent members of their families, and the arrangements will apply from the following territory:

New York State (east of and including Buffalo, Niagara Falls, Suspension Bridge and Salamanca), New Jersey, Pennsylvania (east of and including Erie, Oil City and Pittsburgh), Delaware, Maryland, District of Columbia, Virginia and West Virginia (east of and including Wheeling, Parkersburg, Kenova, Orange and Norfolk).

Children of five and under twelve years of age when accompanied by parent or guardian will, under like conditions, be charged one-half of the fares for adults.

The following directions are submitted for your guidance:

1. Tickets at the regular one-way tariff fares for the going journey may be obtained on any of the following dates (but not on any other date) November 29 to December 4. Be sure that when purchasing going ticket you request a CERTIFICATE. *Do not make the mistake of asking for a "Receipt."*

2. Present yourself at the railroad station for tickets and Certificates at least thirty minutes before departure of train on which you will begin your journey.

3. *Certificates are not kept at all stations.* If you inquire at your home station, you can ascertain whether Certificates and through tickets can be obtained to place of meeting. If not obtainable at your home station, the agent will inform you at what station they can be obtained. You can in such case purchase a local ticket to the station which has Certificates in stock, where you can purchase a through ticket and at the same time ask for and obtain a Certificate to place of meeting.

4. *Immediately on your arrival at the meeting present your Certificate to the endorsing officer,* Walter E. Hadley, Secretary, as the reduced fares for the return journey will not apply unless you are properly identified as provided for by the Certificates.

5. It has been arranged that the Special Agent of the carriers will be in attendance on December 2 to 4, from 8.30 a. m. to 5.30 p. m., to validate Certificatse. If you arrive at the meeting and leave for home again prior to the Special Agent's arrival, or if you arrive at the meeting later than December 4, after the Special Agent has left, you cannot have your Certificate validated and consequently you will not obtain the benefit of the reduction on the home journey.

6. So as to prevent disappointment, it must be understood that the reduction on the return journey is not guaranteed, but *is contingent on an attendance of not less than 250 members of the organization at the meeting and dependent members of their families,* holding regularly issued Certificates obtained from Ticket Agents at starting points, from where the regular one-way adult tariff fares to place of meeting are not less than 67 cents on going journey.

Certificates issued to children at half fares will be counted the same as Certificates held by adults.

7. If the necessary minimum of 250 Centificates are presented to the Special Agent, and your Certificate is duly validated, you will be entitled up to and including December 8, 1926, to a return ticket via the same route over which you made the journey *at one-half of the regular one-way tariff fare* from the place of meeting to the point at which your Certificate was issued.

8. Return tickets issued at the reduced fares will not be good on any limited train on which such reduced fare transportation is not honored.

9. *No refund of fare will be made on account of failure to obtain proper Certificate when purchasing going tickets, nor an account of failure to present validated Certificate when purchasing return tickets.*

THIRTY-SIXTH MEETING OF THE RESEARCH COMMITTEE

The thirty-sixth meeting of the Research Committee of the American Association of Textile Chemists and Colorists was held at the Engineers' Club, Boston, Mass., on October 1, 1926.

The following members were in attendance: Prof. L. A. Olney, E. H. Killheffer, W. C. Durfee, G. A. Moran, W. R. Moorhouse, W. M. Scott, H. W. Leitch, W. H. Cady, H. Christison, W. S. Williams, W. D. Appel, W. E. Hadley.

As was stated in the last Research Committee Report, an endeavor was being made to have our standard methods tried out under the varying conditions of a number of laboratories representing somewhat different requirements and by workers having a somewhat different point of view, in order that the Committee might receive criticisms and suggestions from as many different angles as possible. In order to do this ten representative sets of dyeings upon cotton wool and silk were sent to the following laboratories:

Good Housekeeping Institute.
Laundry Owners' National Association.
Arthur D. Little, Inc.
United States Testing Company, Inc.
Arnold Print Works.
Joseph Bancroft & Sons Company.
Arlington Mills.
Newport Chemical Company.
National Aniline & Chemical Company.
E. I. du Pont de Nemours & Co.

The results of their tests have now all been returned with criticisms and suggestions. These are proving quite valuable to the various subcommittees, which are carefully studying them at the present time, with the expectation of incorporating such suggestions into the revised methods which will be presented at the Annual Meeting.

Progress was also reported by Mr. Cady regarding the work of the Committee on Fastness to Light.

The Chairman made a report in regard to the co-operative work with the British Society of Dyers and Colorists and presented several letters which had been received from the Secretary of British Society, in one of which he announced that the following gentlemen had consented to act on any committee which should be appointed in regard to wool, cotton and artificial silk:

Dr. L. L. Lloyd, Bradford Technical College.
Dr. H. H. Hodgson, Huddersfield Technical College.
A. Singer, I. G. Dyestuffs, Ltd.
Dr. F. M. Rowe, editor of the Colour Index.
J. Huebner, late of the Manchester College of Technology.
L. Stott, Messrs. Smith Bulmer & Co.
H. Jennings, Messrs. Nayler, Jennings Company.
J. R. Hannay, Entwistle, Nr. Bolton.
A. Silverwood, Hon. Secretary of the Society.
I. Walshaw, Messrs. Walshaw, Drake & Co., Ltd.
F. Scholefield, Messrs. Burgess, Ledward & Co., Ltd.
A. B. Steven, West of Scotland Technical College.
Dr. Trotman, Technical College, Nottingham.
Mr. Briggs, British Celanese Company.
Mr. Bowen, Bradford Dyers' Association, Ltd.
Mr. Scafe, Bradford Dyers' Association, Ltd.
Mr. Dunnington, Bradford Dyers' Association, Ltd.
Mr. Holdsworth, British Cotton & Wool Dyers.
Mr. Rawson, British Cotton & Wool Dyers.
Mr. Hirst, British Research Association for the Woolen and Worsted Industry.
F. Smith, Bruntcliffe, Nr. Leeds.

The Chairman also announced that the supplementary revision of the Colour Index of the Society of Dyers and Colourists was being made, consisting of about forty pages of additional material and that he had been invited to act upon the Revision Committee.

Several letters were read from various ones interested in the establishment of standard methods which should be used as a basis for guarantees by textile manufacturers and converters. These were discussed and suggestions made as to a method which would best answer these requirements.

Respectfully submitted,

W. E. HADLEY, *Secretary.*

Applications for Membership

Active Membership

Chasse, Paul, boss dyer, Consolidated Piece Dye Works, Paterson, N. J. Sponsors: W. E. Mitchell and William C. Hall.

Cole, Rotheus P., manager, dyestuff department, Eaton-Clark Company, Detroit, Mich. Sponsors: E. H. Killheffer and L. A. Olney.

Freisinger, Sigmund, silk dyer, New York City. Sponsors: C. C. Knights and A. J. Anderson.

Haas, Walter C., colorist, National Silk Dyeing Company, Paterson, N. J. Sponsors: Ed. F. L. Lotte and Edward Bohl, Jr.

Love, James E., dyer, Marshall Field Corp., Leaksville, N. C. Sponsors: R. H. Souther and Chas. H. Stone.

Schwarz, Dr. Eugene W. K., chemist, General Dyestuff Corp., New York City. Sponsors: F. L. Bume and W. E. Hadley.

Sheldon, Jr., Irving L., superintendent, dyeing and finishing, Everett, Norfolk County, Lebanon, N. H. Sponsors: John H. Grady and M. J. Lane.

Wilson, John L., chemist, O. F. Surn Company, Philadelphia, Pa. Sponsors: W. S. McNab and G. Du Bois.

Junior Membership

Ruffenach, Stephen G., assistant silk dyer, Schwarzenbach Huber Company, Union City, N. J. Sponsors: E. L. Maupai and D. P. Knowland.

Schroeder, Karl P., laboratory assistant, National Silk Dyeing Company, Paterson, N. J. Sponsors: Ed. F. L. Lotte and Edward Bohl, Jr.

Changes of Address

Alter, F. A., 24 Barney Street, Pawtucket, R. I.

Bell, Edward B., 78 West Street, Keene, N. H.

Fidelglotz, Louis L., Star Silk Dyeing Company, Wood and East Seventh Street, Paterson, N. J.

OBITUARY

It is with regret that we learn of the recent death of Raymond V. Roche, who was killed in an automobile accident.

Mr. Roche was a graduate of the Lowell Textile School, Chemistry and Dyeing Department, Class of 1912, and had been associated with the National Aniline & Chemical Company as acting manager of the application laboratory at Buffalo, N. Y.

Sixth Annual Meeting

American Association of Textile Chemists and Colorists

Friday and Saturday, December 3rd and 4th

Charlotte, N. C.

The First Annual Meeting South

CONSIDER this now and plan definitely to go. Good railroad and hotel arrangements are dependent on an early advice from *you* as to your definite intention to go. We expect to have special sleepers from Boston, Providence, New York and Philadelphia. This again depends on *you*.

Please do not postpone your decisions but indicate to the committee now your intention of being one of the party.

COMMITTEE ON PARTICIPATION FROM THE NORTH

Elvin H. Killheffer (Chairman), Newport Chemical Works, Passaic, N. J.
John F. Bannan.....M. T. Stevens & Sons Co., North Andover, Mass.
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AMERICAN
DYESTUFF REPORTER
SAMPLE SWATCH QUARTERLY

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
Directing Editor

CLAYTON HOAGLAND
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October 18, 1926

ASLEEP—OR JUST SLOW?

"IT may seem paradoxical, but is nevertheless true, that the older industries have been the last to recognize the importance and value of research.

"The textile industry, steeped in tradition and prejudice based on technology handed down from generation to generation, has at last called upon the aid of science in the solution of its technical problems."

Optimists may find new hope in these words of Dr. Holland, of the National Research Council, and take new courage from the knowledge that a giant industry is about to awaken to the realization that times, ideas and methods have changed. Again and again experience has shown that competition *cannot* be met with wailing and gnashing of teeth or by artificial protection, but only through alertness and technical superiority. The latter cannot be attained by rule-of-thumb or hit-or-miss methods. The day has passed when common-sense procedure based on very simple and superficial observation can accomplish the gigantic strides demanded by modern competition. Problems have become too complex, technical and involved to be solved by guesswork or by trial and error.

Business men want facts. However, it is what they *do* with the facts that determines success or failure.

Research unearths facts. The textile industry has not the facts it might have were it more progressive in realizing the tremendous value of research.

Of the wealth of statistics available for those in doubt, the following may provoke thought:

The youthful American Telephone & Telegraph Company spends $10,000,000 a year for research. Can the ancient textile industry laugh that off? It is significant indeed that the ten largest industrial concerns in the United States pay a total income tax of $75,000,000, and the majority of these concerns have internationally famous research laboratories.

Dr. F. O. Clements, of the General Motors Corporation, reports that their rubber research applied to fan-belts benefited the entire industry. In plain figures, it resulted in 10 per cent reduction in production cost, 30 per cent in operating costs to the consumer, 50 per cent increased utility of the product and 10 per cent technical information of value to related projects. This alone is convincing proof of the value of research; but even more stupendous savings are taking place in other industries wise enough to invest in research.

Few show it more conclusively than the electrical industry. The first alternating-current lines carried 2,000 volts. Research alone made it possible to carry 44,000 volts in 1900, 150,000 in 1912 and 220,000 in 1926! It is interesting to note that three companies of this industry (General Electric, Westinghouse, and American Telephone & Telegraph) are together spending one-fifth of the total amount appropriated for research in the United States. A remarkable record and profound in its results, for the electrical industry is now a plant of twenty-five billion dollars.

The Bell Telephone Company was using 3 per cent of tin in a lead cable sheath. The price of tin went up and research developed a new alloy using 1 per cent antimony. In ten years this saved $6,000,000. Platinum was replaced by a new alloy, which paid a dividends of $13,000,000 since 1916. Eighty millions were saved by applying the phantom circuit principle to their lines. Research developed loading coils that permitted smaller copper wires to be used, thus saving $100,000,000!

The Victor Talking Machine Company had a profitable business; its common stock dividend paid $42 per share for eleven years. In 1922 a 600 per cent dividend was declared. In the meantime *research* developed the radio—the Victor company passed its dividend. This industry was saved only by the development of the Orthophonic Victrola, which resulted as a side issue from the research on sound made by the Bell System laboratories.

The wood distillation industry in this country represents an investment of $100,000,000. The synthetic production of wood alcohol, due to research in Germany, threatens the loss of this great investment. A few years ago the directors of one of these concerns vetoed an appropriation of only $8,000 for research!

A half-million-dollar plant, manned by an able staff of experts, devoted to the technical problems of the textile industry would be a comparatively small investment, resulting in great progress and *profit*.

If business men want facts, then the handwriting on the wall is indeed plain!

FINIS, AND A CLEAN VICTORY

THE Chemical Foundation case is over. The final decision of the highest tribunal—the Supreme Court of the United States—stamps the third seal of defeat on the Government's memorable suit to recover

the German dye and chemical patents sold by the Alien Property Custodian to the Chemical Foundation. Mountains of testimony were dragged into the case during the three trials to support the voluminous and elaborate briefs prepared by the Government's counsel. A million words or more of argument, large sums of money and time of incalculable value were expended—and all to what avail? Surely the Government must now realize the utter futility of such persistence.

If there had been the smallest basis for any of the Government's numerous contentions, certainly that fact would have been uncovered during three years of close legal examination. But not a charge was sustained in any court; not one accusation proved true. The assertions of a conspiracy back of the patent sale, of an American dye monopoly, of deception of the President and the Custodian, of transgression of executive powers and of violation of the Criminal Code —one and all collapsed as the case progressed from court to court. The Government's first attack was, on its face, an awe-inspiring thing in the complexity of its arguments and the bewildering variety of its allegations. But in the light of justice it disintegrated, breaking off in great chunks like a rock of sand as each allegation was tested against the facts. It shrunk to a mere skeleton of technicalities, and these in turn were riddled in every decision of the courts. The remains, now that the fight is over, should be preserved in the archives of the Department of Justice as an example of the perversity of what the Government called "the law."

The Supreme Court decision, the details of which appear on this page, is largely a rather painstaking interpretation of the Trading with the Enemy Act and an explanation of the powers of the President. In fact, the only reasonable vindication of the Government's action is that it settled quite definitely certain questions arising over the provisions of the Enemy Act and certain expressed doubts regarding Executive power.

Although the Chemical Foundation, it is said, lost $1,000,000 in contending the suit, it is good to feel that it also gained something. In the final verdict especially, its high purposes are emphasized, placing it in a deservedly favorable light. Its ideals are revealed unsullied, now that the libelous attacks of the Government have been nullified, and its functions as an organization working for the public interest are seen all the more distinctly by that public.

Furthermore, the formation of the Chemical Foundation was an episode in the early history of the American dyestuff industry, and the acquittal of the one removes a stain from the record of the other.

Government Loses Chemical Foundation Suit

Supreme Court Decision Upholds Lower Courts in Clearing All Charges

THE decision announced last Monday by the Supreme Court of the United States marked the close of the famous Chemical Foundation suit. The Government, by that decision, lost its long fight to recover the German dye and chemical patents confiscated during the war and later sold by the Alien Property Custodian to the Chemical Foundation, a company organized to license the patents to American manufacturers for the purpose of building up an American chemical industry. The decisions reached by the two lower courts were upheld in every point.

The Supreme Court verdict covered the same ground as that of the Circuit Court of Appeals, which in turn had received the case from the District Court of Delaware, and it completely affirmed both of the earlier decisions. Justice Butler, who wrote the decision, reviewed the entire history of the case, outlining the situation in the American chemical industry prior to the war, the formulation of the plan to confiscate the alien-owned chemical patents under the Trading with the Enemy Act, and the subsequent organization of the Chemical Foundation, as well as the many details of the sale itself, such as the order issued by President Wilson and the latter's delegation of power to Custodian Frank L. Polk.

As in both previous trials, the Government's contentions of conspiracy were found to be without support of fact, and, according to this last decision, "findings of fact concurred in by two lower courts will not be disturbed unless clearly erroneous."

The Supreme Court decision was principally an interpretation of the provisions of the Trading with the Enemy Act and of the powers of the President and the Custodian. The court declared:

> The Custodian was a mere conservator and was authorized to sell only to prevent waste. But brief experience made it clear that this restriction on the power to dispose of enemy property sometimes operated to defeat the purpose of the Act and brought profit and advantage to the enemy. And it authorized the Custodian under the President to dispose of such properties by sale or otherwise "in like manner as though he were the absolute owner thereof."

In refuting the complaint of the Government that the President acted without complete knowledge of the facts, the decision avers:

> The President will be presumed to have known the material facts and to have acted in the light of them. His intention to ratify the sales is plain.

The comprehensive language used is broad enough to include the patents. Moreover, the statement that his reasons for the determination are given in the Polk orders shows the intention to cover the properties there referred to.

The Government's charges of violation of the Criminal Code by those involved in the transfer of the patents were likewise broken by the Supreme Court in a statement to the effect that the Criminal Code provisions do not cover the acts of the Alien Property Custodian.

The Art of Dyeing 100 Years Ago

Extracts from an Old Book on Chemistry by J. L. Comstock, M.D.

THE REPORTER recently received a communication from James A. Branegan, president of the Kali Manufacturing Company, Philadelphia, concerning an interesting rare old volume in his library, entitled "Elements of Chemistry," published almost a century ago. Through the courtesy of Mr. Branegan the REPORTER has been able to obtain extracts from the book, which are printed below principally because of their peculiar historic interest. Mr. Branegan comments on the book as follows:

"You will notice that Dr. Comstock is an M.D., and not a doctor of chemistry. This book was written at Hartford, Conn., in 1831, and was published by Pratt, Woodford & Co., 63 Wall Street, New York City. The book contains 420 pages, and the first twelve pages are in fine print and devoted to the study of *English grammar*. Evidently the author believed it necessary for the student to know something about English grammar and syntax before going into chemistry, and took no chances.

"This book contains many expressions which are foreign to the chemists of to-day, such as 'affinity,' 'attraction,' 'vegetable acids,' 'oxygenized water' and 'caloric,' the last meaning any kind of heat, such as latent heat, heat of reaction, etc. There is an article on carbo-sulphuric acid. This, the writer states, parades under two other names—'xanthogene' and 'hydroxanthic' acid. I finally figured out what the writer had in mind: it was our old friend carbon-bisulphide. There are nice descriptions showing how to make ink, and also an interesting article on fermentation, which seems to have been an important industry in those prehistoric days."

Following are the sections on "Art of Dyeing" and "Calico Printing":

ART OF DYEING

Under the article coloring matter, we have given a few of the principles of the art of dyeing, but the importance of the subject in connection with the arts of life, makes it proper that we should here refer more particularly to those processes, in which Chemistry is directly concerned.

In the first place, the goods to be dyed, are to be thoroughly cleansed from oily, or gummy matter; this is called scouring. Goods which have been previously bleached, that is, whitened, by laying them in the sun, and wetting them with lye water, or by the process of chlorine bleaching, require little, or no preparation for the dye. The ordinary course at dyeing establishments, where the goods are received directly from the loom, is the following: :

The linen, or cotton goods, being first washed in warm water, are then bowked, as it is termed, that is, boiled in a weak solution of caustic potash, then washed in large quantities of water, and spread upon the grass, so as to be exposed freely to the joint agencies of air, and light, and moisture. This operation, which sometimes takes a week, or more, may, however, be superseded by the careful application of a weak solution of the Chloride of Lime. This part of the preparation being finished, the goods are immersed in water, slightly acidulated with sulphuric acid, and again thoroughly washed, and dried. By these operations, the texture and durability are without doubt, more or less injured, and especially when Chloride of Lime is used unsparingly, in order to hasten the process.

With respect to the nature of the materials to be dyed, it is found that different substances not only possess different affinities for the coloring matter, but that this is absorbed by them in very different proportions. Wool appears to have the strongest attraction for the coloring principle; silk comes next; then cotton, and lastly linen and hemp.

The simple operation of dyeing, that is, plunging the material into the dye tub, is generally, though not exclusively performed on animal substances, as wool, and silk, while the more refined art of printing in devices and patterns, is done on cotton, forming as a whole, the business of calico printing, an art, which, with simple machinery, produces nearly the whole effect of the most labored and refined drawing in colors.

We have already stated that most colors require some intermediate substance, in order to make them combine with the fibre, whether animal, or vegetable, and that where they do not require such a substance, they are called substantive colors, but where they do, they are called adjective colors. The base so required, is called a mordant. The substance to be dyed is first impregnated with the mordant, and then passed through a solution of the coloring matter, which is thus fixed in the fibre, and becomes as it were, a part of it. That a considerable portion of the dye is permanently retained in the fiber is proved by the experiments of Dr. Ure, who found that 100 parts of the ashes of Turkey-red calico, which has an alum mordant, afforded 16 or 17 parts of alumina, while the

ashes of white calico afforded only a trace of that earth.

CALICO PRINTING

This is considered the most refined and tasteful branch of the dyer's art. It is a species of topical dyeing, or printing in colors. The mordants, the principal of which are acetate of alumina, and acetate of iron, are first applied to the calico by means of wooden blocks, or copper plates, upon which the requisite patterns are engraved. The color flies from those parts, which have not received the mordant, but is permanently retained on those which have been touched by the blocks. That variety of color which we see on calicoes, is produced by employing various mordants and different coloring materials. Another method is to put on the mordant and the coloring matter at the same time, but in these cases particular management is required in the selection of the substances employed, and in the manner of their application. When this method is used, the color is fixed by a steam heat of 212 deg.

White spots, upon a dark ground, as in mourning calico are sometimes produced by covering the part intended to be kept white, with wax, pipe clay, or some other material which prevents the contact of the color. Another method is, to apply citric acid, thickened with gum, which being put on the plate, or block, is applied in the same manner with the mordant. This will prevent the color from being retained. Sometimes the color is discharged in spots by the application of chlorine in the form of bleaching powder, or chloride of lime, a process well illustrated in what are known under the name of Bandana handkerchiefs.

CHEMICAL SECTION SPEAKERS SECURED

Members of the National Safety Council who attend the Chemical Section sessions at the fifteenth annual safety congress, to be held in Detroit from October 25 to 29, inclusive, will hear nationally known speakers discuss timely accident prevention problems. Both members and non-members will be welcome at the gathering.

Among the speakers expected to deliver addresses are: Dr. L. W. Fetzer, chairman, Industrial Poisons Committee, A. C. S., who will make a report of the Occupational Disease Committee of the American Chemical Society; B. L. Huestis, of the Bureau of Explosives, who will discuss the transportation of chemicals and explosives; Dr. H. F. Smyth, of the University of Pennsylvania, who will make a progress report of the Spray Coating Committee; Ethelbert Stewart, Commissioner of Labor Statistics, who will dwell on "Safety in the Chemical Industries"; Prof. C. E. A. Winslow, of Yale, who will make a final report of the N. S. C. Benzol Poisoning Committee; S. H. Katz, of the U. S. Bureau of Mines, will tell of "Dust and Gas Masks—Their Design and Efficiency"; Dr. E. C. Davidson, of the Henry Ford Hospital, is to dwell on "The Treatment of Chemical Burns."

The Dyer's School of Experience

[EDITOR'S NOTE.—*The following narrative is one of a series being published under the general head of "The Dyer's School of Experience." Realizing that the genuine material for such a series is to be found largely among its own readers, The* REPORTER *solicits contributions from that source and will pay for those accepted at regular space rates. Among the readers of this journal there should be many who have, in the course of their experience as dyers or chemists, encountered incidents which should prove most interesting and helpful to their fellows. Send all manuscripts to* AMERICAN DYESTUFF REPORTER, *90 William Street, New York City.*]

PROBLEMS IN PIPE LINES AND WATER

By NOEL D. WHITE

Davenport Hosiery Mills, Chattanooga, Tenn.

IN the course of my career in the dyehouse one thing more than anything else gave me the most concern· water—the quality and quantity of it.

When I started out to learn the trade I found employment in some of the biggest dye plants in existence, and naturally while there I never gave a thought to the water supply. The big plants, as a rule, take good care that the water supply is adequate and of the best.

It is in the small dyehouse and in the mill dyehouse especially where I found my troubles with water, of which I am going to write this time.

I had never given any thought to water; had taken it as a matter of course until the time I got my first job in the dyehouse attached to a ribbon mill. After about a year there we were given a vacation for a week for repairs in the dyehouse. They were going to change the water pipes—put in larger ones.

They had been working here for over ten years with water supplied by a two-inch pipe extending the whole length of the dyehouse. You will understand what that meant when I tell you that this dyehouse had four compartments running in a straight line, one after the other. Starting from one end at the entrance, there was the skein dyeing room, fifty feet wide and sixty feet long, with seven vats ranging from seven to twelve feet in length, lined up on one side, heads to the wall and a faucet for each vat. Next in line came the blacks dyehouse both for skein and piece goods. This was nearly 80 feet long and had seven vats on one side 12 feet long. After this came the colored piece dyeing room also 80 feet long with vats of various length all lined up to the wall as above, and last came the loading room in which there were, besides the five vats for loading, three 14-feet long vats used for dyeing big lots of light shades and white. On the other side of the rooms described the same arrangements prevailed.

Now can you imagine a two-inch pipe supplying water

to all those vats. Of course, those vats were not drawing water all at the same time, but if only two or three needed water, as was often the case, someone or all had to wait with loss of time and of the dyers' temper.

The manager told me he had complained from the beginning that the water supply was inadequate, but they had gone along those many years until the pipes had rusted out and now they were obliged to change them.

This time they put in a four-inch pipe line and everyone was satisfied.

But that had started a new line of thought in my mind, and when I left this place to take charge of a small plant, my first thought was: What kind of water will I have there?

I soon found out. They had city water, filtered at the waterworks. Clear enough for consumption, as good as the average but too muddy for the production of clear white goods.

They had a small filter installed in the dyehouse but that I did not know how to use, and nobody else knew. So I had to find my way out.

For ordinary purposes, colors and blacks, I used the water as it was. For whites, as I found that the last sour wash was the cause of my uneven dyeing I used to fill up a vat with water and a little acetic acid. Passed in it a lot to be dyed dark colors or black to clean it, then finished my whites in it. Now and then I made a new one and that solved that problem for me for as long as I kept the job.

One-Inch Reasoning

From here we will take a trip to a city in Pennsylvania. A ribbon mill proprietor had called on me on Sunday, a week before I was to start work for him, so I could direct the laying out of steam and water pipes to supply the vats and kettles in his new dyehouse.

When we came to the water part of the program he showed me that they had a reservoir tank above the roof of the boiler-room, big enough for the plant. From this tank a one-inch pipe was put in the dyehouse running against the wall on one side of the room and partly down another side. Inspection of the water proved it to be soft and as clear as crystal. He told me I could head it from the pipe anywhere I wanted it. Seeing the size of the pipe I said it was not big enough but he advised me that as long as it was already in to use it and see what it would do. I told him I would do so, and that there was no use extending the pipe any farther. With a piece of rubber hose I could carry the water wherever it was needed. After giving him instructions in regards to location of steam valves and tub I left the mill.

On Monday the following week I reported for work and during that week I did what I could to keep abreast with the production. But I was falling steadily behind. The week after, I gained but little and on Saturday of the second week the boss, who journeyed from New York where he lived to this mill every Saturday, came to see me in the dyehouse and started a lecture on the advisability of having the work out of the dyehouse in proper time so as not to delay the shipping of the goods.

I agreed with him, but I told him that the water tank, while big enough, was placed too low and the supply pipe being so small and no pressure, there was an unnecessary waste of time waiting for water to fill my vats and that caused the delay in my deliveries. When he asked me what I thought would be an adequate pipe for the water I needed I said three-inch pipe would do and a four-inch pipe would be better.

He threw up his hand and declared that with a four-inch pipe the reservoir tank would be drained too fast. There would not be water enough left to supply the steam boiler. That was a knock-out. I was nonplused and could not find anything to answer for a while to such reasoning. This occurred in 1911, therefore before the Volstead act went on the statute book. Next to this mill there was a brewery running full force. I had managed to get friendly with the brewing master and that gentleman had invited me over to visit his works and to taste of his product. Before I left he told me that he always kept a barrel on tap and that I was welcome to go to it any time. Now I happened to think about it and being Saturday and my work over, I said to the boss if he had no objections we would go over to visit the brewery and would talk over the pipes afterwards. He agreed and together we walked over to see our neighbor.

Luckily we found the master in the sampling rooms. He showed us around and pointed to a tank ready to be tapped. I asked him the capacity of that tank. It was a one-hundred barrel tank. When I noticed the size of the faucet I asked the brewer if by doubling the size of the faucet, couldn't he fill twice as many barrels? I will never forget the look he threw in my direction. It meant: How can you be such a dumb-bell! He said nothing, however, and I did the same. I looked at my employer and caught a smile on his face. The thrust had gone home. When we adjourned and went back to the mill he told the superintendent to call a plumber next Monday and let me order the proper water pipe to supply the dyehouse.

From that time no more delay occurred in my work.

Now we will go to that city in Connecticut where the superintendent proved to be such a friendly fellow. This place was advertised to have the best water for dyeing purposes in the country.

They had a big pond back of the dye plant. I often went there to watch the fishes and listen to the frogs when I was at leisure. The pond was full of vegetation, water lilies and everything. I was shown the filtering system. I cannot describe the working of that system further than to say that it effectively prevented pumping into the tower tank any twigs, leaves, etc. No frogs nor fishes could ever hope to pass through that water-work system, but the water that came in the dyehouse had the color of India Pale Ale of bygone days.

I asked the superintendent why he didn't correct it and

have it come in clear and he told me all it needed was a seven-foot bed of sand and that he would do it some time in the future.

I could have told him that he needed more than that to clear that water. A solution of sulphate of alumina in small quantities would break up that vegetable matter and hold it in suspension; then the sand could filter out. That was exactly what he needed but I kept my counsel, and when we needed a vat of clean water for light shades all we did was to take a lot of boiled-off silk for black and give three or four turns in it, then use it for the light shades.

For white we had an iron tank full of charcoal about fifty gallons capacity, and the water used for finishing the lot was made to pass through that charcoal and from that into the finishing vat. I did not stay long there, so I had nothing to worry over that. Maybe to-day they have remedied that.

Queer Filter Trouble

The next place is Massachusetts. When I was given that job the parting words from the men who had engaged me in New York were that I should not go up there and start finding faults with the equipment and go to a lot of expense.

When I got there I found the water supply the very worst that could be imagined.

We had two water lines here. One was supplied from the river, muddy and yellow from decayed matter. There was a 1½-inch pipe to supply eight vats, most of them 14 feet long. Drawing water in one tank only by actual count it took fifteen minutes to fill it.

The other line was supplied with city water coming through a meter. The mill being at the lowest part of the town, we got all the sediments in the pipes. Whenever they shut off the water for repair of some kind and every time they opened the valve to test the fire apparatus the water came as dirty as the river water and stayed so for hours. In ordinary times it was not much good. Once, when it was supposed to be clean, I tied to the spout several thicknesses of cloth in the shape of a bag and after filling a vat I took it off to look in it. I found the cloth covered one-eighth of an inch thick with a slimy substance the color of the darkest coffee grounds. I showed my findings to the superintendent and advised him that a filter of some kind would be the best way out.

The supply from the city water was a one-inch pipe. And to think that for sixteen years my predecessor had endured this condition. I had been told that as the city water was rather expensive I was to use as far as possible the water from the river. I argued that with a filter I could use the water from the river at all times, but they were not ready for a filter just then, so I showed him the amount of time I wasted in waiting for the water coming from a one-inch pipe and persuaded him to change the pipe from a one-inch to three inches. Before he agreed to that he said it would be an awful expense to use city water from a three-inch pipe. I then told him the brewery incident and he laughed and said he never thought of it that way.

He had a three-inch pipe put in right away and of course a three-inch meter went with it.

A little while later the New York manager came up. He had heard of the change in pipes and wanted to see. I filled up a vat by the watch and it took just one and a half minutes. He was pleased with the result. Then looking at the meter he remarked: "The water bill for next month will bankrupt the firm!"

I looked at the superintendent and he looked at me, smiling; then he said: "He will not use any more water than before. He will only get it quicker."

It does not seem possible that intelligent people, as they are supposed to be, could come to such conclusions, but there they are. Three of them were unable to see without telling them that I could not possibly use more water than I needed even if it came through a larger pipe, since the size of the vats were the same.

About three months after that we put in a filter. Hungerford & Terry was the name. It worked admirably for a while. The principle of that was to break up the slime in the water and filter out through a bed of sand.

A triplex pump would pump the water from the river and force the water through a two-inch pipe for about 20 feet into a hermetically sealed iron drum filled with sand. The water entering from the top was forced to the bottom, leaving all the slime in the sand, and the clear water would then proceed to the reservoir tank of about 1,000 gallons capacity, situated near the roof in a corner of the dyehouse.

Opposite the pump were two wooden tanks of about 100 gallons capacity. One had a solution of sulphate of alumina, the other a solution of sal soda. Both stood on a platform about a foot from the floor, connected to a small rectangular vat a foot high, two feet long and about two feet wide, with four compartments. The solution would flow from each tank in a separate compartment of this tank, through half-inch pipe fitted with a stopcock and a glass bulb to stop the flow when the compartment was full.

To the pulley that drove the triplex pump was attached a steel rod connected to a geared wheel and ratchet. To the wheel was fastened an iron rod running across the box fastened at the edge and to this bar there were attached two brass cups held in position by a brass pipe.

Each revolution of the pulley would move the ratchet up and lower the cups a little. After so many revolutions the cups would dip in the respective solutions, then start upwards and spill the contents in the other two compartments in front and from here they would be sucked into the water to be doped. The sulphate of

alumina would break up the slime, the soda would neutralize the acidity from the alumina.

Every night I measured the contents of the vats with a yard stick and for every so many inches that was used up I added one pound of soda or of alumina, and filled up the tanks with water.

The thing could be regulated to flow as much or as little as necessary to get the water clear. It worked well. I was delighted with it. Being my first experience with a filter naturally I enjoyed keeping it in good working condition.

Now I had plenty of water and as clean as I wished to have it, and for a while I was sailing with the wind.

After I had seen the dirt I collected from the city water in that piece of cloth I swore off drinking it. This town had voted no license, but Boston was only a few miles to the east in the next county and I could reach it in about forty minutes, but when my filter started producing such inviting and purified water, my trip to that city became less frequent. Then one day something went wrong. My filter refused to produce clean water without apparent cause. I went over every step of the operation, and cleaned the sand bed by reversing the flow of water from the top to the bottom. I did everything that I could think of. Then I sent for the expert, as I was supposed to do in a case like that.

The man came and tested and manipulated but got no results whatever. It would not clean any more water. That man stayed with it the better part of three days, and when he left he told me he had never struck such a condition before in all the time he was in the filtering business. He took with him a gallon of water from the river to analyze it again and try to find out what change had taken place to produce such a condition.

In the meantime, the superintendent had suggested that perhaps a large machine shop, which was a quarter of a mile up the stream, had let loose the pickling solution they used for tempering iron; that would change the chemical property of the water.

Acting upon that suggestion I started changing the proportion of the chemicals in the tank until I found that by eliminating entirely the sal soda and reducing to one-half the amount of alumina I got as good if not quite the same result as before.

When I told my findings to the expert when he came back he could not believe it. He said that theoretically it was wrong, it did not agree with their formulas and experience and he did not understand it; but the fact was that the filter was doing its work under that condition and I did not care for his theories as long as I was getting results. In two weeks' time the stream had resumed its former condition. Being a sluggish river it took about that long to carry all the pickling acid contamination past our mill, and I had to go back to the same proportions of soda and alumina as when we first started and for all the years I remained in that place that was the thing to do.

Now we come to a place where everything was going to be ideal. This firm had started out to build a mill up to date in every respect. All the equipments was the best procurable. When I took charge of their dyehouse they had been doing business about four months. They had a bleaching plant and a dyehouse with just enough equipment to dye their production, intending to add gradually as the business grew. City water was used here but as the water was hard a Permutit System of filtering was installed with a capacity three times as large as was needed, to take charge of future expansion.

It looked now as though I would have no more troubles as far as the water supply was concerned. It was as clear and as soft as it is possible to make it and I had plenty of it. They put up a water tower—a large tank to hold about 2,000 gallons, and the superintendent took charge of that job.

Now as I was in charge of the dyeing, and had given a good account of myself from the start, I was the only one there who had real knowledge of how a dyehouse should be equipped, and I naturally thought that I would be consulted about the proper size of the pipes to be fitted to that tank. I knew the management had the greatest confidence in me as a dyer and yet they had more faith in their superintendent as far as equipping and making arrangements in my dyehouse was concerned, although that man had never worked in a dyehouse before. He went to work, took his measurements, ordered what he wanted and the first time I knew about what was going on, was when a lot of piping came in, all cut to sizes and threaded, ready to be hooked up.

When I saw they were all two-inch and one-inch pipes I sought out the superintendent and asked him if he intended to use those sizes for a pipe line in the dyehouse. He said that was what he wanted to do. I argued that while that was all right at present with the small equipment I had, in a short time it would be utterly inadequate. I told him of the several experiences I had with too small a supply of water and explained what a waste of time it would cause to be waiting for water. I talked to that man until I was black in the face. I all but actually wept to see the mistake I had witnessed so many times when I could not help it, perpetrated right under my nose, but all to no avail.

He connected that tank and fitted my dyehouse with a pipe line two inches in diameter and a feed pipe from the filter to the reservoir of one-inch pipe. When I pointed out the absurdity of one-inch feed pipe to the tank he told me that that pipe would feed the tank even when I was asleep.

Of course, I knew that in time it would have to be changed. This was a progressive concern and would not stand for anything that would cause delay in production if it could be avoided.

But why did they not listen to expert advice and avoid unnecessary expense I never could figure out. I believe

they thought my engineering capacity was not equal to my dyeing capacity, and I let it go at that. Before six months had passed a plumber came in, changed that line and put in four-inch, three and one-half, and three-inch pipes as I told them was needed.

We all need education and education is expensive.

Influencing the Absorption of Colors by Cotton and Wool

Pre-Treatment of Wool—Wool and Alkalies—Retarded Affinity—Treatment of Cotton

IN dyeing mixed fabrics of cotton and wool it is useful in many instances to have a knowledge of the means of regulating and controlling as closely as possible the speed of absorption of color by these fibers. Many methods of treatment are already known which are useful in encouraging or restraining the absorption power of wool.

For instance, the affinity of wool for coloring matter may be increased by treating it with a solution of hypochlorite and dilute acid. At the same time, with this particular treatment, wool gains notably in luster but loses the property of felting mechanically. Nevertheless, the method is used for producing two-color effects on all-wool fabrics, by treating the wool in the yarn state before weaving. Non-treated wool and chlorinated wool are woven together in a predetermined style. The chlorinated wool has a yellowish coloration and a greatly increased affinity for coloring matters. In dyeing such a mixed fabric the temperature of the liquor must be lower than ordinarily, and without the customary addition of acid.

Wool and Alkalies

A method which was proposed many years ago for increasing the affinity of wool coloring matters consists in treating the fiber with strong solutions of alkalies. Wool is very easily acted upon by alkalies, but their action varies greatly according to the temperature and strength of the solution. Very strong caustic soda at 71 to 106 deg. Tw., at the ordinary temperature, strengthens the wool during the first five to ten minutes; beyond this time the tensile strength diminishes. The increased affinity so acquired by the wool for coloring matters has been made use of for the production of two depths of the same color in the printing of woolen fabrics.

It had been also observed that the affinity of the animal fibers may be increased by treatment with a solution of sulphocyanide. The material is boiled for an hour in a 5 per cent solution of sulphocyanide of potash. It is possible to vary the degree of affinity by varying the concentration of the solution, but the affinity, once imparted, is stated to be durable. This method finds most application in chrome, mordant, and acid dyeings.

In place of the sulphocyanides an easily decomposable ammonium salt may be employed—for example, the carbonate, acetate, or formate. In application the wool may be treated in a hot 2 to 3 per cent solution of neutral carbonate and ammonia, raising the temperature in the course of half an hour to the boil, and continuing the manipulation at the boil for one hour. The same effect can be produced by boiling wool in a weak solution of bisulphite of soda. When coloring matters are applied which are not influenced by bisulphite, it may be added directly to the dyeing liquor.

To remove the agent from the wool after dyeing, various means are used, such as boiling for some time in water, or water slightly acidulated with sulphuric acid, or a treatment with formaldehyde or chlorine.

Retarded Affinity

Just as methods have been evolved for increasing the affinity of the textile fibers for coloring matters, so others have been devised for restraining it. A notable one of this class is the treatment of wool with concentrated sulphuric acid. This method may be utilized for the production of color effects. The strong acid is applied in very small amounts to the surface of the wool by means of suitable brushes, blocks, or engraved rollers, before the dyeing.

By another method the wool is treated with an acidified solution of thiosulphate and soda. The wool is treated for 1½ hours in a solution at 50 deg. Cent., containing 24 per cent thiosulphate of soda and 16 per cent of hydrochloric acid. Very varied color effects are obtainable by this method as it imparts to the wool greatly-increased affinity for the basic and vat dyes, and a decreased affinity for the azo, acid, direct and mordant dyes.

A further method is known for the production of multicolored effects on all wool material. The treatment consists in boiling the material in a liquor containing 10 to 20 per cent tannin, and 20 to 25 per cent of formaldehyde, followed by washing and drying. Yarn so treated may be woven along with yarn not treated, and the resulting fabric dyed in an acid liquor (additional acetic acid or alum). The treated portion becomes colored, whereas the non-treated remains practically non-colored.

Treatment of Cotton

Turning to cotton, there is, of course, the widely known instance of mercerization, producing an increased affinity of the fibers for coloring matters. Other methods are known for augmenting and for retarding the affinity of cotton—for instance, the treatment of cotton with tannin and a salt of tin. In this case the cotton loses its prop-

erty of absorbing the direct dyes, but at the same time it is suitably mordanted for taking up the basic dyes.

A further process is based on the observations that a large number of dyeings capable of resisting the action of hydrogen peroxide can be easily destroyed in the presence of catalytic reagents. The cotton yarn is mordanted in the usual manner with tannin, and treated in a solution of acetate of copper; dried, and passed through a hot solution of sulphite of soda. The yarn is then associated with ordinary yarn in the weaving, and the fabric produced dyed, say, with a suitable direct blue. After dyeing, the fabric is treated in a warm solution of hydrogen peroxide, with the result that the previously-treated portions become decolorized to any desired extent.

An interesting proposal for retarding the affinity of cottons for coloring matters is serviceable for obtaining effects in different colors. Cotton yarn is treated in a strong solution of cerium chloride, dried, subsequently woven along with ordinary cotton yarn. The fabric is then dyed either with the direct or the sulphur colors. One of these colors is absorbed more strongly, and the other much less so by the treated fiber than by the non-treated, and so double effects are directly obtained. In some circumstances it may be desirable to remove the color imparted to the cotton by the cerium oxide present, and that may be accomplished by treating with a solution of bisulphite of soda acidified with acetic acid.—Textile Argus.

The Reduction Products of Azo Dyes

Part XXII

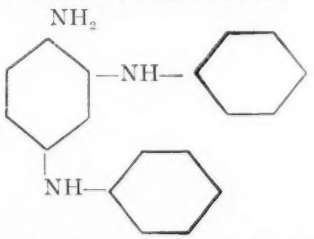
By WALTER C. HOLMES

Color Laboratory, Bureau of Chemistry

[EDITOR'S NOTE.—*The most practical and effective method for the identification of azo dyes consists in the isolation and identification of the products which they yield on reduction. This method finds less application than it might or should, partly because some of these products have never been isolated and investigated, and partly because much of the data which has been obtained in regard to such reduction products is greatly scattered and very difficult to locate.*

Mr. Holmes has made a search for all the available information on such reduction products, and this series contains a digest of his results with a systematic listing of the reduction products of the azo dyes published in the Colour Index, together with the available data on such properties and reactions as would be of service in their identification.]

No. 286—1-AMINO-2, 4-DIPHENYL-m-PHENYLENEDIAMINE



$C_{18}H_{17}N_3$; Mol. Wt. 275.25; (C, 78.5%; H, 6.2%; N, 15.3%).

Derived from C. I. No. 309.

Slightly yellowish needles, mpt. 107°. Sp. sol. in H_2O or ligroin, mod. sol. in ether, benzene or warm alc.

Boiled with excess formic acid it yields formylanilido-N-phenylmethnylphenylenediamine, colorless needles, mpt. 124°. With acetic anhydride an analogous product is obtained, cryst. granules, mpt. 165°.

Boiled with CS_2 (and alc.) it yields a condensation product, yellow needles, mpt. 208°.

With nitrous acid it yields anilinoquinonephenylimide, brick-red warts, mpt. 125°.

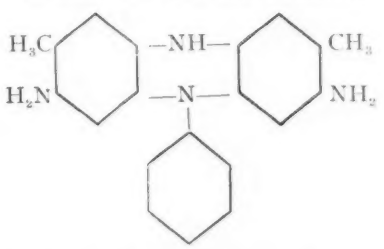
No. 287.—DIAMINOPHENYLAMINO-METHYL-DIPHENYLAMINE SULFONIC ACID

$C_{19}H_{20}N_4O_3S$; Mol. Wt. 384.35; (C, 59.3%; H, 5.2%; N, 14.6%; O, 12.5%; S, 8.3%).

Derived from C. I. No. 11.

No data available.

No. 288.—LEUCO SAFRANINE



$C_{20}H_{20}N_4$; Mol. Wt. 316.29; (C, 75.9%; H, 6.4%; N, 17.7%).

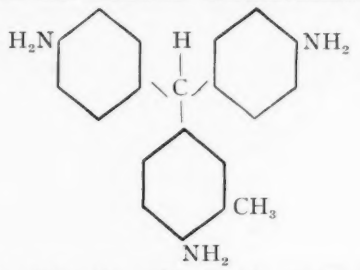
Derived from C. I. Nos. 133 to 137.

From these dyes it is obtained in admixture with the tolyl isomer and (in the instance of C. I. No. 135) the leuco compounds of safranines of bluer shades.

In 33% Ac HO sol. these leuco safranines reduce methylene blue in the cold, with the formation of safranines and leuco methylene blue and the consequent color change from blue to red.

They are very readily oxidized to safranines (by this, or other, means) and may be recognized by their color reactions, etc. They dissolve in H_2SO_4 with a green color, turning blue and finally red-violet or red on dilution.

No. 289.—LEUCO ROSANILINE



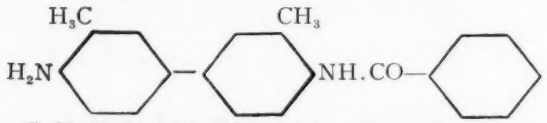
$C_{20}H_{21}N_3$; Mol. Wt. 303.29; (C, 79.2%; H, 7.0%; N, 13.8%).

Derived from C. I. No. 603.

Small cryst., mpt. 100°. Triacetyl deriv., needles (Ac HO), mpt. 168°.

Best identified by conversion into rosaniline by oxidation.

No. 290.—BENZOYL-o-TOLIDINE



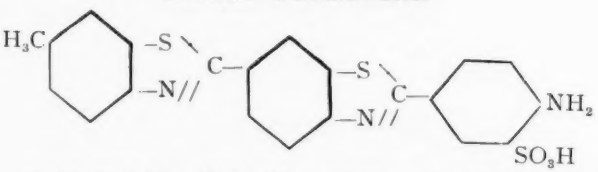
$C_{21}H_{20}N_2O$; Mol. Wt. 316.28; (C, 79.7%; H, 6.4%; N, 8.9%; O, 5.1%).

Derived from C. I. No. 111.

Crystals (alc.), mpt. 198-200°. Insol. in H_2O or ether, mod. sol. in alc.

The diazo deriv. is somewhat sol. in cold H_2O but may be salted out readily. It crystallizes from H_2O at 60° in yellow silky glistening crystals.

No. 291.—PRIMULINE



$C_{21}H_{15}N_3O_3S_3$; Mol. Wt. 453.43; (C, 55.6%; H, 3.3%; N, 9.3%; O, 10.6%; S, 21.2%).

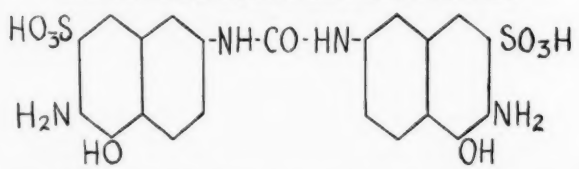
Derived from C. I. Nos. 220, 221, 222 (223 to 226), 227, 228, 231, 233 (632), and 646 to 650.

In these dyes it may be found associated with the lower [$C_{14}H_{12}N_2O_3S_2$, dehydrothio-p-toluidine sulfonic acid] and the higher [$C_{28}H_{18}N_4O_3S_4$] members of the primuline series.

Orange-yellow grains (salted out from H_2O).

The NH_4 salt, unlike that of dehydrothio-p-toluidine, is relatively soluble. For identification see under C. I. No. 812.

No. 292.—7, 7′-DISULFO-6, 6′-DIAMINO-5, 5′-DIHYDROXYNAPHTHYL-2, 2′-UREA

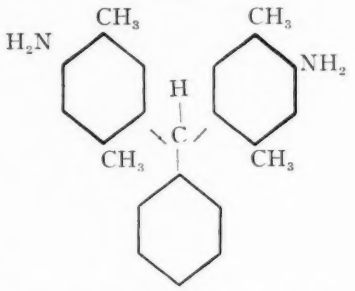


$C_{21}H_{18}N_4O_9S_2$; Mol. Wt. 534.40; (C, 47.2%; H, 3.4%; N, 10.5%; O, 26.9%; S, 12.0%).

Derived from C. I. No. 327.

No data available.

No. 293.—DI-(p-AMINOXYLYL)-PHENYL-METHANE



$C_{23}H_{26}N_2$; Mol. Wt. 330.34; (C, 83.6%; H, 7.9%; N, 8.5%).

Derived from C. I. No. 357.

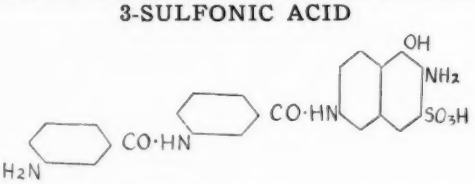
Light yellow prisms (alc.), mpt. 208°. Readily sol. in benzene and hot alc., sp. sol. in ether and cold alc., insol. in H_2O.

Diacetyl deriv., white silky needles (alc.), mpt. 217°.

Dibenzoyl deriv., white cryst. (alc.), mpt. 249-50.

With nitrous acid the base yields a phenol which melts at 162°. The latter compound gives a diacetyl deriv., white needles (alc.), mpt. 158°.

No. 294.—m-AMINO-BENZOYLAMINO-m-BENZOYL-6-AMINO-2-AMINO-1-NAPHTHOL-3-SULFONIC ACID

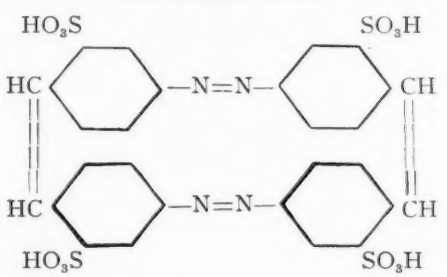


$C_{24}H_{20}N_4O_6S$; Mol. Wt. 492.37; (C, 58.5%; H, 4.1%; N, 11.4%; O, 19.5%; S, 6.5%).

Derived from C. I. No. 324.

No data available.

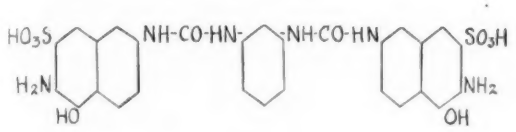
No. 295.—DISAZO DISTILBENE TETRA SULFONIC ACID



$C_{28}H_{20}N_4O_{12}S_4$; Mol. Wt. 732.57; (C, 45.9%; H, 2.8%; N, 7.7%; O, 26.2%; S, 17.5%).

Derived from C. I. Nos. 620 and 622 in the form of its Na salt by alkaline reduction. For properties see under C. I. No. 621. On further reduction it yields diaminostilbene disulfonic acid (No. 262).

No. 296.—7, 7′-DISULFO-5, 5′-DIHYDROXY-6, 6′-DIAMINO-2, 2′-DIAMINO-DICARBONYL-2, 6-DIAMINOTOLUENE-4-SULFONIC ACID

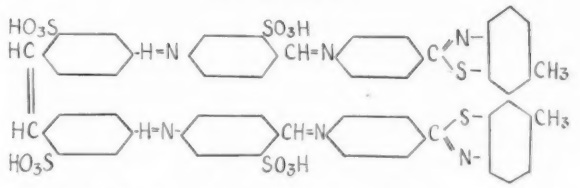


$C_{29}H_{26}N_6O_{13}S_2$; Mol. Wt. 730.52; (C, 47.7%; H, 3.6%; N, 11.5%; O, 28.5%; S, 8.8%).

Derived from C. I. No. 328.

No data available.

No. 297.—HEXASULFONIC ACID OF THE DEHYDRO-p-TOLUIDIDE OF AZO-STILBEN-ALDEHYDE



$C_{56}H_{40}N_8O_{18}S_8$; Mol. Wt. 1369.14; (C, 49.1%; H, 3.0%; N, 8.2%; O, 21.0%; S, 18.7%).

Derived (in the form of its Na salt) from C. I. No. 634 by alkaline reduction. For properties see under C. I. No. 635. On further reduction it yields diaminostilbene disulfonic acid, o-sulfo-p-toluidine and dehydrothio-p-toluidine.

Technical Notes from Foreign Sources

Dyeing and Washing Apparatus

British Patent No. 253,500 describes an apparatus employed for washing and dyeing purposes and in which particular attention is paid to the circulation of the liquids through the materials. The circulation is accomplished by means of a rotary pump, and the vats for the materials and the pump itself are made relatively movable so that one pump may be employed for a number of vats.

FIG. 1.

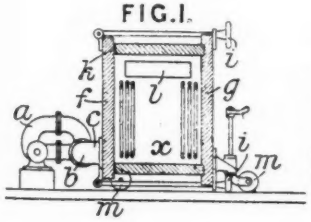
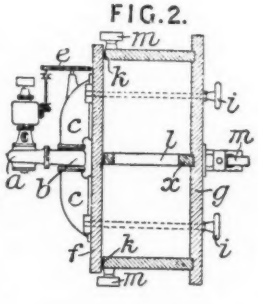


FIG. 2.



In one form a vat of wood is mounted on rollers m so that it may be brought up to a rotary pump a which has branches c and a reversing valve b actuated by gearing e. The vat has a medium wall x in which is an opening l, and one side of the vat is constituted of a stationary wall f, through which the branches lead, connected to the vat by clamping rods i, a tight joint being made by rubber bands k. In a modification the pump is mounted on a carriage together with an electric motor and a reservoir for liquid and is moved up to a stationary vat.

Mordanting and Dyeing Wool

Wool is mordanted by means of a dichromate and sodium thiosulphate, so that the dichromate is completely reduced to chromium hydroxide, since a mordant in this state gives the fastest shades to light, milling, and potting with suitable mordant coloring matters. In most cases the resulting shades are brighter and deeper than similar shades on wool mordanted by the usual methods.

For example, 500 pounds of wool are treated for twenty minutes at a temperature of 90 to 93 deg. Cent. with a solution which contains 10 pounds of sodium dichromate, then 15 pounds of sulphuric acid are added, and, after a further twenty minutes, 5 pounds of sodium thiosulphate and ¼ to ½ per cent (calculated on the weight of the wool) of borax or ½ to 1 per cent of sodium acetate. The mordanting is completed within a further thirty minutes.

The addition of borax or sodium acetate prevents the deposition of sulphur. Subsequently the mordanted wool is treated in the same or a separate bath with a milk alkali such as sodium carbonate or ammonia at a temperature of 60 to 93 deg. Cent. This results in the complete conversion of the mordant in the wool into chromium hydroxide. The wool may be frequently dyed afterwards in the exhausted mordanting liquor. (British Patent No 253,662.)

Bleaching Wool with Hydrogen Peroxide

In finishing any fabric or yarn, each process through which it is put has a certain harmful effect on the fiber and entails certain losses. Furthermore, when one process causes a certain injury in the fiber, it is more than likely the next operation will increase the extent of this injury. Hence the investigation to determine the exact conditions under which an operation should be carried out is of prime importance. Thus, in washing the wool prior to bleaching with chlorine it is often possible to injure the

wool and then the bleaching operation will carry the injury still further along.

Hydrogen peroxide easily releases its oxygen but in order to obtain the best bleaching results the evolution of oxygen must be very gradual. A slight bleaching only is obtained when the bleach bath is unstable, for then molecular oxygen is evolved which has not bleaching action. The important factors which control the stability of a hydrogen peroxide liquor are the following:

In the first place there is the reaction of the liquor, whether it is alkaline or acid. In the second place there is the temperature, and finally the presence of a catalyst or anti-catalyst. The latter two conditions are too well-known to require any explanation at this point. Investigation has shown that sodium silicate is the most favorable of all alkalies to use for the neutralization of the bleach liquor, for it is not only a neutralizing agent but also acts as an anti-catalyst or stabilizer.

When chlorinated wool is compared with direct bleached wool, it is found that in the first case a greater weight loss is entailed than in the latter case. It is then established with certainty that the percentage of injured fibers in the mass of wool after bleaching unchlorinated wool has not noticeably increased, but that this was the case with the chlorinated wool.

The percentage of hydrogen peroxide employed varies and increases generally with the alkalinity of the liquor. Chlorinated fabrics appear to require more hydrogen peroxide than the non-chlorinated. This can be concluded to be due to the sulphur dioxide which is contained in the fibers and which has not been removed.

The percentage weight loss is irregular. It is, however, much greater for the chlorinated wool than for the non-chlorinated. The best white is obtained with alkaline bleach liquors and hence this means that careful attention must be paid to regulating the alkalinity of the liquor. (Deutsche Faerber Zeitung, 1926, page 848.)

ARTIFICIAL SILK IN COTTON FABRICS OPENS NEW MARKETS

The manufacture of cotton fabrics with an admixture of artificial silk, resulting in the production of cotton with a silken finish, has greatly stimulated the output and consumption of cotton textiles, according to statements made by E. V. Peters, vice-president of the Tubize Artificial Silk Company, who is attending the convention of the National Association of Cotton Manufacturers in Boston.

The combination of these two products, Mr. Peters points out, may prove the salvation of the cotton industry and bring about a large increase in the demand for cotton textiles. A healthy growth i nconsumption fo this new product has already been experienced, enabling many cotton mills to increase production, thus giving increased employment to mill hands, many of whom have been idle during the recent years of depression in the textile trade.

RECENT PATENTS

Azo Coloring Matter Dyeing Wool Fast to Milling and Process for Obtaining the Same

(1,598,109; August 3, 1926)

James Baddiley, James Hill and Albert Riley, Manchester, England, assignors to British Dyestuffs Corporation Limited, Manchester, England.

New azo coloring matters dyeing wool fast to milling in various shades, which can be obtained by diazotizing the condensation product of formaldehyde and a single primary aromatic amine and combining with sulphonated azo dye compounds.

Use of Hydrosulphites or Sulphoxylates in Removal of Dyes from Textile Fibers

(1,594,670; August 3, 1926)

Charles S. Hollander, Philadelphia, Pa., assignor to Rohm & Haas Company, a Corporation of Delaware.

Process of stripping dyes from dyed materials which consists in immersing such materials in a mixture of a substantially insoluble sulphoxylate formaldehyde and a readily soluble substantially neutral salt of a substance whose hydroxide is strongly alkaline.

Method of Dyeing Bone and the Product Thereof

(1,594,490; August 3, 1926)

Elmer C. Bertolet, Philadelphia, Pa., assignor to George K. Hale Manufacturing Company, Philadelphia, Pa., a Corporation of Pennsylvania.

The herein-described method of coloring bone material, consisting in subjecting it to a mixture of coloring matter, stearic acid, kerosene and cresol.

A bone material or product completely penetrated to a substantial depth with coloring material.

Azo Dyes Derived from Monoacylacetyl Bodies and Process of Making Same

(1,594,865; August 3, 1926)

Arthur Zitscher, Offenbach-on-the-Main, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.

Textile material dyed with one of the new azodyestuffs as covered in claim 7, said dyestuff being developed on the material.

Azo Dyes Containing a Diphenylurea Nucleus

(1,594,805; August 3, 1926)

Henry Wenker, Hamburg, N. Y., assignor to National Aniline & Chemical Company, Inc., New York, N. Y., a Corporation of New York.

As a new dyestuff, a diphenylurea containing a para-aminobenzene-azo-1, 8-aimnoaphthol-azo-benzene sub-

stance having a sulphonic acid group in the naphthalene nucleus, which dyestuff in the dried and pulverized state, and in the shape of an alkali metal salt, is a dark powder soluble in water, yielding upon reduction with stannous chloride and hydrochloric acid a triamino-8-naphthol sulphonic acid, a diaminodiphenylurea and an aryl monamine derivative, and which dyes cotton green shades which can be readily discharged by the action of discharging agents.

Disazo Dyestuffs Containing a Diphenylurea Nucleus

(1,594,828; August 3, 1926)

Leon W. Geller, Hamburg, N. Y., assignor to National Aniline & Chemical Company, Inc., New York, N. Y., a Corporation of New York.

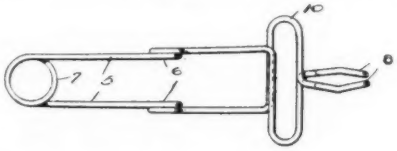
As new products, the azo dyestuffs obtainable by subjecting a mixture comprising 4-hydroxy-4'-aminoazobenzene-5-carboxylic acid and 4'-chlor-2-methyl-5-alkoxy-4-aminoazobenzene-5'-sulphonic acid in the presence of sodium carbonate to the action of phosgene, said dyestuffs, in the dried and pulverized state and in the shape of their sodium salts, being yellowish brown powders soluble in water with a yellow color and soluble in concentrated sulphuric acid with a yellowish red color, yielding upon reduction, 2-chlor-5-aminobenzene sulphonic acid, 2-hydroxy-5-aminobenzoic acid, and 4.4'-diaminodiphenylurea bodies which upon hydrolysis decompose into diamino bodies of the benzene series, and carbonic acid; and dyeing unmordanted cotton reddish yellow to greenish yellow shades which are capable of being discharged to a white with sodium hydrosulphite.

Test-Tube Holder

(1,594,792; August 3, 1926)

Alfred C. Mortimer, Winthrop, Mass., assignor to L. E. Knott Apparatus Company, Cambridge, Mass.

In a holder of the character described, in combination, a handle portion comprising a wire bent back upon itself,



gripping jaws and intervening connections including a reverse bend at each side of the handle, whereby, as the handle portion is more tightly gripped, a corresponding pressure is exerted by the gripping jaws.

Process of Producing Multicolor Effects on Vegetable Fibers and Product Thereof

(1,594,853; August 3, 1926)

Julius Rath and Wilhelm Christ, Offenbach-on-the-Main, Germany, assignors to the I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.

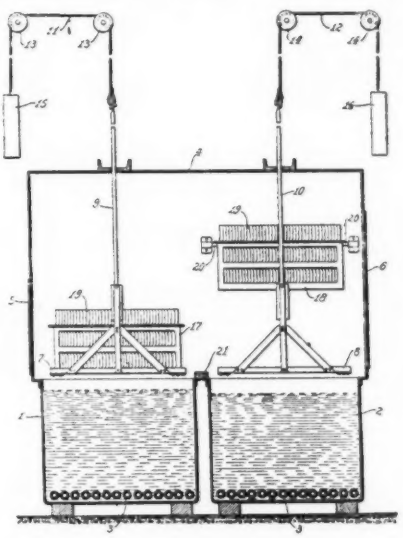
A process of producing multi-color effects or combined shades on the vegetable fiber, consisting in superimposing vat dyestuffs on fabric portions which have been previously treated with such azodyestuffs as are resistant to the action of boiling dilute caustic soda solution in the presence of cellulose, that is fast to kier-boiling.

Art of Impregnating or Waterproofing Materials

(1,594,375; August 3, 1926)

Arthur S. O'Neil, Alton, Ill., assignor to Western Cartridge Company, East Alton, Ill., a Corporation of Delaware.

In the art of impregnating or waterproofing porous materials, the process comprising, immersing the material



in a hot bath and transferring the material to and immersing the same in a bath at a lower temperature, the material being passed through a heated chamber during such transfer, substantially as and for the purpose set forth.

Process and Apparatus for Saturating Fibrous Materials

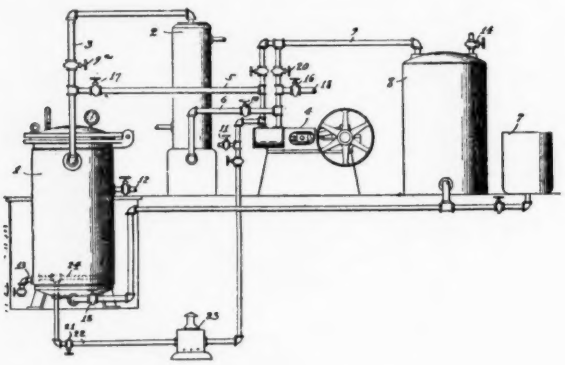
(1,598,376; August 31, 1926)

William R. Howard, Santa Barbara, Calif., assignor to The Raybestos Company, Bridgeport, Conn., a Corporation of Connecticut.

A continuous process for saturating substantially non-flexible fibrous substance, consisting in drying the fibers in a container and drawing off the evaporated moisture, in then adding a saturating fluid to the container, in removing the saturating fluid after saturation of the fibrous substance and then subjecting the fibrous substance while still in the container to the action of a heated circulating oxidizing agent.

In an apparatus for saturating fibrous substances, the combination with a saturating retort for treating said

substances, of a means for drying the fibrous substances, means connected to the retort whereby the moisture may be relieved therefrom, means for introducing and with-



drawing a saturating fluid and maintaining it under pressure during saturation, and pressure means for introducing an oxidizing agent subsequent to saturation.

FOREIGN TRADE ITEMS

PRODUCTION OF DYESTUFFS IN FRENCH PLANTS DECLINES IN 1925

According to the annual report of the French dyestuffs union (Union des Producteurs et des Consummateurs pour le Developpement de l'Industrie des Matieres Colorantes in France) the production of dyestuffs in French-owned plants showed a slight decline in 1925 at 14,549 tons as compared with 14,978 tons in 1924. The production in recent years has been as follows:

Year	Metric Tons	Year	Metric Tons
1920	7,356	1923	10,968
1921	8,832	1924	14,978
1922	8,065	1925	14,549

This decline has been accounted for by the smaller production amounts of indigo and sulphur colors. The tonnages in the above years of dyestuffs other than indigo and sulphur dyes were as follows:

Year	Metric Tons	Year	Metric Tons
1920	2,508	1923	6,572
1921	2,407	1924	7,977
1922	4,678	1925	8,271

Imports for the year were distinctly lower than in 1924, totaling only 1,451 tons, as compared with 2,444 tons in the preceding year. Of the total for 1925, 388 tons were brought in from Germany, and 915 tons from Switzerland. Imports in recent years were as follows:

Year	Metric Tons	Year	Metric Tons
1920	5,584	1923	1,370
1921	1,134	1924	2,444
1922	1,797	1925	1,451

While the production of the Swiss owned plant at St. Fons is not available, it is estimated that its output for the year was slightly higher than in 1924, when it totaled approximately 1,500 tons; with this output, the total dyestuffs production in France in 1925 was between a minimum of 16,000 tons and a maximum of 16,500 tons.

During the past few months several trade opportunities for sales abroad of coal tar and coal-tar derivatives have been published in Commerce Reports, which have received but little attention from American exporters. Indications are that the foreign demand for these products from the United States will increase, as diminished production in England, because of the coal strike, and in Germany, owing to the increasing use of lignite, is causing purchasers who formerly depended upon these sources to look elsewhere in anticipation of their future requirements.

INCREASED IMPORTS OF FOOD COLORS INTO SOUTH AFRICA

The Union of South Africa imported 70,819 pounds of food coloring in 1925, 5,000 pounds more than in 1924. The United Kingdom was the source of over 90 per cent of the total importation. The United States increased its share of this trade from 298 pounds in 1924 to 1,132 in 1925.

The use of dyes in foodstuffs and beverages is permitted in all parts of the Union. Although the enactment of a national pure food law has been pending for several years, regulation of the use of food colors remains at present within the jurisdiction of the various Provinces. Several Provincial laws permit the use of any coloring not injurious to health.

The recent expansion of the Punjab Government Dyeing School and Model Dyeing Factory in Shandara, near Lahore, India, should be regarded by American dye manufacturers as an excellent opportunity to acquaint the staff and students with their products by submitting color cards and samples to Consul E. Verne Richardson, Karachi, India, who will transmit them to the school.

CHINESE IMPORTS OF ANILINE DYES AND INDIGO

Importers in China of aniline dyes and artificial Indigo generally had a poor time during 1925. The imports throughout China fell greatly. This was true also of Manchuria, where values declined from $540,509 for imports in 1924 to $337,223 for imports in 1925.

Competition was very keen, and that, together with the depreciation of the local currency, gave importers many difficult problems to contend with, according to Consul Sokobin, Mukden, China.

On the other hand, imports of Indigo, so far as quantities are concerned, showed a large increase for 1925, when 8,198,500 pounds were imported, as compared with 4,486,400 pounds in 1924. Prices were low, due to the same keen competition as in aniline dyes.

NEW SODA ASH FACTORY IN CHINA

Shanghai, China.—A soda factory will shortly be promoted in the Kwangtung Leased Territory (China) with a capital of 15,000,000 yen, according to information received here. The Mitsubishi and Mitsui companies and the Manchurian Railway are to be owners. The enterprise is the outcome of a plan formulated by Dr. Nishikawa Torakichi, technical adviser to the Asahi Glass Company.

The new company will purchase the Asahi Company's plant in Tobata, Kyushu, which will be transferred to the Kwangtung territory. The government-general of the Leased Territory is said to consider the enterprise worth helping and will, it is reported, grant a subsidy beginning with the fiscal year of 1927-1928.

The Osaka Jiji, however, understands that the problem of protection for the industry will be studied by the Japanese Government Department of Commerce after the company has begun operations.

Much importance is attached in Japan to the venture, the success of which will reduce the import of soda ash from other sources. At the present British material is consumed to the extent of 90 per cent of the total amount bought by Japan.

I. G. INCREASES CAPITAL

Trade Commissioner Daugherty at Berlin has advised the Department of Commerce that the German dye trust has increased its capitalization by 454,000,000 marks ($108,097,400 at the current exchange rate of 23.81 cents). A statement issued by the department, based on Mr. Daugherty's report, follows in full text:

"At a general meeting of stockholders of the I. G. Farbenindustries A. G., the so-called German dye trust, held recently in Frankfort-on-Main, an increase in capital from 646,000,000 marks to a total of 1,100,000,000 marks was approved unanimously.

"This increase will result in an issue of three categories of shares: (1) 258,400,000 marks of new common; (2) 150,000,000 marks of new 6 per cent preferred (Series A), and (3) 35,600,000 marks of 3½ per cent preferred (Series B) with tenfold vote rights.

"A block of 128,320,000 marks of common stock is at the disposal of I. G. stockholders. Another portion of 41,880,000 marks new common stock will be devoted to exchanges consummating fusions with local explosive plants; the Koeln-Rottwell formal fusion is believed in Germany to be imminent, while it is reported that Dynamit-Nobel and Rheinischs Sprengstoff A. G. will be merged in 1931.

"The new I. G. capital foundation will thus include: 900,000,000 marks of common stock; 160,000,000 marks of preferred (Series A), and 40,000,000 marks preferred (Series B)."

NO DUMPING OF POTASH FOUND

The Department of the Treasury announced October 2 that its investigation, instituted June 22, had disclosed no warrant for invoking provisions of the Anti-Dumping Act against shipments of phosphoric acid from Germany, and has directed the United States appraiser of merchandise at New York that appraisement reports covering such merchandise need no longer be withheld.

An investigation was started on complaint of a domestic manufacturer, the Treasury's letter to the New York appraiser disclosed, but that inquiry had shown that there had been only one shipment of the acid from Germany since April.

VICKERS & SONS CELEBRATE CENTENNARY

This month the British firm of Benj. Vickers & Sons, Ltd., of Leeds, oil manufacturers in the textile industry, is celebrating its one hundredth anniversary and has distributed an interesting leaflet narrating the early history of the company. Three successive generations of the same family have had entire control of its policy.

In the original days, when Leeds was a center of the local clothing industry, the wool was spun and cloth was woven in the valleys of Yorkshire, and was then brought down by pack-horse to the Leeds cloth market. The manufacturers would sell their cloth and with the proceeds would buy the dyes, oil, etc., which they required for the next lot.

Within the last twenty years business has completely changed; certain grades have been standardized, but even yet, unlike ordinary olein distillers, who are limited to two or three products suitable for wool, by judicious blending of the very many and varied raw materials available Messrs. Vickers are able to produce oils to suit practically any class of wool.

The whole technology of oil in its application to wool is still in its infancy, and every research and investigation simply serves to open up fresh fields of research which need specialized attention. The effects of oil on card clothing and the theoretical basis of the processes of milling are at present under close investigation.

NEW CARD SHOWS DIRECT COTTON COLORS

An exceptionally attractive and well bound shade card just issued by John Campbell & Co. shows this manufacturer's complete range of direct colors for cotton, which are produced under the brand names of Amidine, Sol-Amidine and Develop Colors.

The folder displays eighty-six different shades on cotton yarn, including the interesting series of fourteen Amidine Develop colors. Percentages are given for each swatch, and the text gives dyeing directions for obtaining the various shades. The card should be of considerable reference value to cotton dyers.

DU PONT SCARLET 2R

The dyestuffs department of E. I. du Pont de Nemours & Co. announces the development of Du Pont Scarlet 2R for Lakes, a product which when converted into the barium lake is a very blue scarlet with a very bright and transparent top masstone. It is said to have good fastness to light and acid, and is non-bleeding in oil.

SEPTEMBER DYE IMPORTS SLIGHTLY LARGER

Imports of foreign dyes through the port of New York and other ports amounted to 387,533 pounds in September, with an invoice value of $322,446. Imports by ports were as follows: New York, 355,937 pounds, with a value of $295,917; Albany, 19,625 pounds, with a value of $12,977; Boston, 11,633 pounds, with a value of $12,861; Detroit, 338 pounds, valued at $691. Detailed imports will appear in a later issue.

GRANDAGE IS PROMOTED TO ASSISTANT GENERAL MANAGER OF CLARK THREAD

The Clark Thread Company, Newark, N. J., has announced the appointment of Herbert Grandage as assistant general manager. Mr. Grandage has been superintendent of bleaching, mercerizing and dyeing at the Clark Thread Company, and manager of its Bloomfield, N. J., works since 1921. In his new capacity he will exercise entire supervision over both the Newark and Bloomfield plants.

Mr. Grandage was born in Bradford, England, June 12, 1891, and came to the United States at an early age. After attending both the Philadelphia Textile School and the Pratt Institute, Brooklyn, he entered the textile field as assistant dyer at the Industrial Dyeing & Finishing Company, Frankford, Philadelphia, and later became superintendent of bleaching and dyeing at the Bay State Thread Works, Springfield, Mass., where he remained until 1919. For the next two years and just prior to joining the Clark Thread Company, he was superintendent of bleaching and dyeing for Gerald Cooper, Providence, R. I.

TEXTILE DIRECTORIES MERGE

According to an announcement from the Davison Publishing Company, Dockham's American Report and Directory of the Textile Manufacture and Dry Goods Trade has been consolidated with Davison's Textile Blue Book and Textile Buyer's Guide. Dockham's Directory, established in 1866 by C. A. Dockham, has been published continuously for sixty years. Davison's equally well-known Blue Book and the Buyer's Guide have been used in the industry for forty years.

Edward P. Bell is now overseer of dyeing at the Faulkner & Colony Manufacturing Company, Keene, N. H.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

SPLENDID OPPORTUNITY

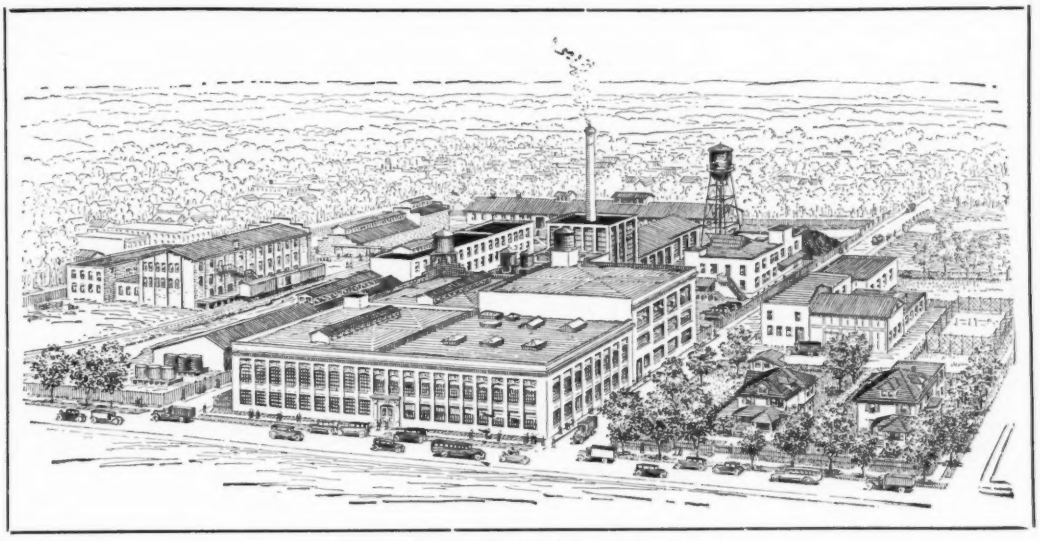
Owner of half interest in old established operating cotton dyehouse in Philadelphia, moving away; will dispose of his interest to one or two capable men. Write and express ideas if interested and owner will reciprocate. Room for supervision as well as investment. Address Box 354, American Dyestuff Reporter.

DYE WORKS MANAGER

Dye works manager, at present managing large works in Britain doing almost exclusively vat colors on piece goods, yarns and artificial silk, wishes to enter first-class works in U. S. A. in similar capacity. Advertiser is 43 years of age, had first-class chemical training on Continent and is considered an expert in the application, and also manufacture, of vat colors. He has had exceptional experience in the designing and erecting of works and plants; is capable of handling large numbers of men and to take sole charge of a big concern. Firms requiring a real live wire and first-class organizer please communicate in the first place. Address Box 356, American Dyestuff Reporter.

GRINDING MILLS

The proprietors of United States Patent No. 1537759 of May, 1925, for improvements in Grinding Mills, are desirous of entering into reasonable arrangements for exploiting same in U. S. A., either by license or by sale of the patent outright. The invention is being successfully worked in Great Britain as the "Circulator" Mill and repeat plants have already been supplied in many foreign countries, including U. S. A. The machine finds a great outlet in the Paint, Colour, Chemical, Calico printing, Linoleum and other industries, not only for fine wet or dry grinding but also for the efficient production of Emulsions, Dispersions, &c. Address in first instance to Box 573, Smith's Agency, Ltd., 100, Fleet Street, London, Great Britain.



Plant of Jacques Wolf & Co., Passaic, N. J.

Dependability

WOLF BRAND
SPECIALIZED TEXTILE CHEMICALS

MONOPOLE OIL
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BLEACHING OIL
SOLUBLE OILS
CREAM SOFTENERS
HYDROSULPHITES

—in finishing, dyeing, bleaching, printing and other arts in the creation of popular cotton and rayon fabrics, is paramount. Your sales depend on quality—buyers are critical and demand the *best*.

Dependability in the source of your supply for textile chemicals is the basis of successful manufacturing and merchandising.

Our customers include the largest in their respective lines. We please *them*. Their requirements are most exacting. We are confident of pleasing you and of serving you with the same efficiency that has won us our high standing in the specialized textile chemical industry.

Review our lines and ask for full information and prices.

JACQUES WOLF & CO.

MANUFACTURING CHEMISTS AND IMPORTERS

PASSAIC, N. J.

Mid-West and Pacific Coast Representatives
The Ciba Co., Inc.
Chicago, Ill. San Francisco, Cal.

The Boss Printer Knows—

1. Goods have a better bottom
2. Colors take better
3. Yellowness, due to improper bleaching, is eliminated.
4. Rejects are fewer when OAKITE is used in processing.

YOU are certain to get better printing if your goods are processed the OAKITE way. And better printing is what your boss printer wants.

For, when OAKITE materials are used in connection with kier-boiling, soaping, scouring and other finishing operations, goods have a better bottom, colors take more evenly, and yellowness is done away with.

And here is why. OAKITE has unusual cleansing power. It removes every last trace of dirt, oil, soap, and sizing materials from fabrics, and leaves them in perfect condition for perfect printing.

Send for our booklet "Wet Finishing Textiles." It gives the facts.

Oakite Service Men, cleaning specialists, are located at

Albany, Allentown, Pa., *Atlanta, Ga., Baltimore, *Boston, Bridgeport, *Brooklyn, Buffalo, Camden, Charlotte, N. C., *Chicago, *Cincinnati, *Cleveland, *Columbus, O., *Dallas, *Davenport, *Dayton, *Denver, *Des Moines, *Detroit, Erie, Flint, Mich., *Grand Rapids, Harrisburg, Hartford, *Indianapolis, Jacksonville, Fla., *Kansas City, *Los Angeles, Louisville, Ky., *Milwaukee, *Minneapolis, *Montreal, Newark, Newburgh, N. Y., New Haven, *New York, *Oakland, Cal., Philadelphia, *Pittsburgh, Portland, Me,. *Portland, Ore., Providence, Reading, *Rochester, Rockford, Rock Island, *San Francisco, *Seattle, *St. Louis, Springfield, Ill., Syracuse, *Toledo, *Toronto, *Tulsa, Okla., Utica, *Vancouver, B. C., Williamsport, Pa., Worcester.

**Stocks of Oakite Materials are carried in these cities.*

OAKITE

TRADE MARK REG. U.S. PAT. OFF.

Industrial Cleaning Materials and Methods

OAKITE IS MANUFACTURED BY OAKITE PRODUCTS, INC.

formerly OAKLEY CHEMICAL CO. 54a THAMES ST., NEW YORK, N.Y.

110

Onyx Oil & Chemical Co.

Oils, Chemicals, Gums and Finishes

for the

THROWSTER, DYER, FINISHER AND PRINTER

Headquarters for

SANITOSE
Reg. U. S. Pat. Off.
A superior silk finish

SILTEX GUM
Reg. U. S. Pat. Off.
The new printing gum

DECERESENE
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The chemical degummer

Office and Works: Jersey City, N. J.

Our Laboratory at your service.

Hydroxy Oils for every Rayon problem

HYDROXY ART SILK CONING AND WINDING OILS—to meet YOUR condition.

HYDROXY ART SILK BOIL OFF OIL—for boiling out Coning and Winding Oils before Dyeing.

"SOLIVOL B"—for Softening Bleached and Dyed Rayon.

HYDROXY THREE FIBRE BOIL OFF OIL—degums Pure Silk and Boils out Coning and Winding Oils at the same time.

HYDROXY ART SILK SIZE—for Slashing and other purposes.

Write for a copy of "Popular Textile Chemistry," by James A. Branegan, President Kali Mfg. Co.

The KALI Mfg. Co.

Manufacturing Chemists

1410 N. Front Street, Phila., Pa.

SHADES ON WORSTED FABRICS

FALL 1926

QUANTITIES OF DYES INDICATED ARE FOR 100 POUNDS OF CLOTH

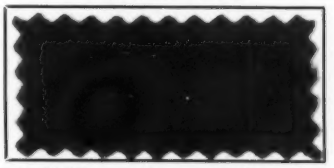
RADIO BLUE

1.68 % National Alizarine Sapphire SE
0.21 % National Wool Orange 2 G Crystals
0.236% National Fast Wool Yellow 3 GL

PEONY RED

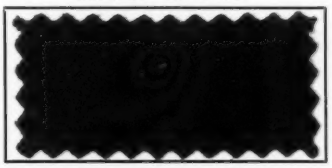
1.12 % National Fast Wool Red BL
0.096% National Alizarine Sapphire SE
0.42 % National Wool Orange 2 G Crystals

GLACIER BLUE



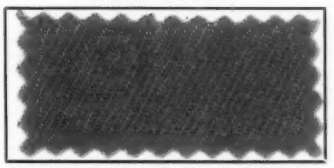
0.388% National Alizarine Sapphire SE
0.084% National Fast Wool Red GL
0.102% National Fast Wool Yellow 3 GL

CAMEO BROWN



0.216% National Alizarine Sapphire SE
0.66 % National Wool Orange 2 G Crystals
0.4 % National Fast Wool Red GL
0.7 % National Fast Wool Yellow 3 GL

SURF GREEN

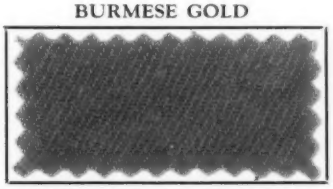


0.106 % National Alizarine Sapphire SE
0.0088% National Wool Orange 2 G Crystals
0.2 % National Fast Wool Yellow 3 GL

BURNT SIENNA

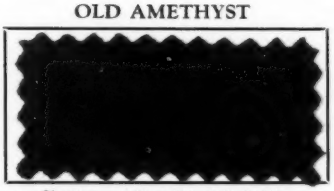
0.41% National Alizarine Sapphire SE
1.12% National Wool Orange 2 G Crystals
0.59% National Fast Wool Red GL
0.3 % National Fast Wool Yellow 3 GL

BURMESE GOLD



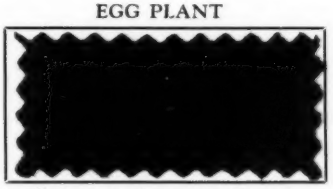
0.054% National Fast Wool Red BL
0.014% National Alizarine Sapphire SE
0.33 % National Wool Orange 2 G Crystals

OLD AMETHYST



0.3 % National Fast Wool Red BL
0.216% National Alizarine Sapphire SE
0.304% National Wool Orange 2 G Crystals

EGG PLANT



0.84% National Alizarine Sapphire SE
1.12% National Fast Wool Red GL
0.15% National Fast Wool Yellow 3 GL

WINTER LEAF

0.208% National Alizarine Sapphire SE
0.186% National Wool Orange 2 G Crystals
0.176% National Fast Wool Red GL
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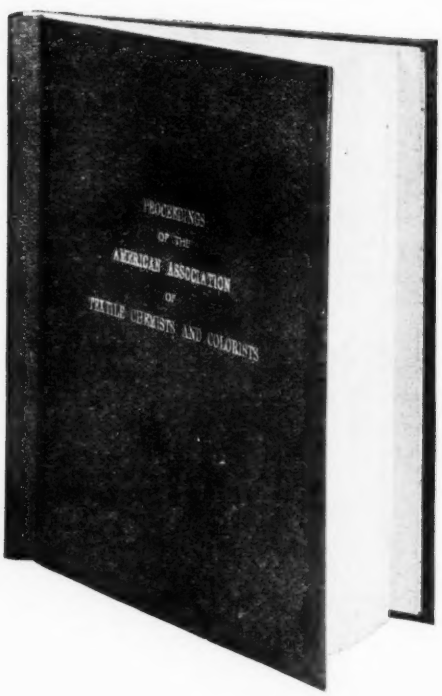

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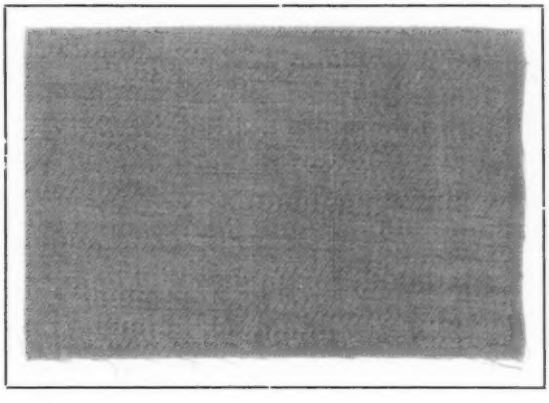

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